Clinical Signs in Small Animal Medicine

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Contents

Abbreviations

AIHA	autoimmune hemolytic anemia
ARDS	acute respiratory distress syndrome
BPH	benign prostatic hyperplasia
BUN	blood urea nitrogen
DIC	disseminated intravascular coagulation
DKA	diabetic ketoacidosis
DOCP	desoxycorticosterone pivalate
EPI	exocrine pancreatic insufficiency
FeLV	feline leukemia virus
FIP	feline infectious peritonitis
GI	gastrointestinal
IM	intramuscular
ITP	idiopathic thrombocytopenic purpura
IV	intravenous
MODS	multiple organ dysfunction syndrome
NPO	nothing by mouth (nil per os)
NSAID	nonsteroidal antiinflammatory drug
OD	overdose
OP	organophosphate
PCV	packed cell volume
PDH	pituitary-induced hyperadrenocorticism
PU/PD	polyuria/polydipsia
SAMe	s-adenosyl-l-methionine
SC	subcutaneous
SG	specific gravity
SIRS	systemic inflammatory response syndrome
TCO_2	total carbon dioxide
TEN	toxic epidermal necrolysis
TP	total protein

Introduction

You might look at this book and wonder what motivated me to do a picture atlas of small animal medicine in light of all the science that constantly embraces us in the modern veterinary literature. My answers are simple. The main reason is that there is no substitute for looking at the animal and observing its lesion or abnormal movement when it comes to making a clinical diagnosis. It is this philosophy that I was taught by my mentors at the Animal Medical Center (AMC) in New York City in the 1970s, and it is still the way I continue to teach my students up to the present day. The other important reason is that I wanted to leave a meaningful legacy to this profession and, with so many wonderful textbooks being published, I wanted the images in this book to complement the written words of my colleagues.

Western man's revision of the ancient Chinese proverb 'A picture is worth ten thousand words' became 'One look is worth a thousand words', as contributed by Fred R. Barnard in the advertising trade journal ***Printers' Ink*** in 1921. In 1927 Barnard republished this in an advertisement as 'One picture is worth ten thousand words'. Regardless of the origin and subsequent modifications, the value of actually seeing the lesion is especially valuable and irreplaceable in the learning of medicine, whether it be worth one thousand or ten thousand words.

As stated above, one of the main objectives for doing this text is to provide a graphic representation of disorders that many clinicians will encounter in their practice of medicine. This desire first dawned on me during my internship at the AMC in 1970, at which time my salary was $6,500 and the unbelievably large case load made me forget that I was starving. There was no way for me to buy the camera with a 'macro' lens that my more senior colleagues were using. So, with great frustration I had to wait for my residency in medicine, at which time I was able to borrow the cost of a new 'Nikon Nikormat' camera with its very special macrolens, which was subsequently paid back with $35.00 taken from each paycheck. From that moment on my camera accompanied me at my patients' 'cage side', where I recorded images that would hopefully some day enhance my real desire to teach clinical medicine.

The images selected for this book are amongst the many thousands in my collection. They have been selected because of the unique clinical situations they represent. At times the reader will find that I have presented more than one version of a particular clinical sign; this has been done in order to show that many syndromes can have several different presentations. What compelled me to show one disorder and not another was again dictated by the uniqueness of the picture and, perhaps, the rarity of certain conditions; however, the reader will find exceptions to this discretionary guideline, where some conditions might not be so rare.

I tried initially to represent most organ systems and keep the images distributed evenly amongst them. However, I soon saw that organ systems such as gastroenterology and endocrinology play a major role in an internist's image collection, so this will explain why there is a disparity amongst the various systems. At first I envisioned a book that would provide pictures of just about every topic covered in textbooks such as Ettinger and Feldman's ***Veterinary Internal Medicine***, but the size of such a book would be just too unmanageable and probably too costly. So, perhaps the topics not illustrated will motivate me to publish a 2nd edition in the future.

The organization of this text is purely to emphasize the imagery of medicine. From the very first moment we walk into the client waiting room and the examination room, our eyes immediately fixate on the patient after first greeting the pet owner. This is the beginning of our examination and this is where 'a picture is definitely worth a thousand or even ten thousand words'. Of course we should always be careful not to fixate on the lesion and forget about the rest of the patient. One way of avoiding this medical pitfall is to focus on the problem only after first thoroughly examining the patient. While mentioning the word 'pitfall', this might be the best place to share with you some philosophical thoughts that I have written down over my 37 years of practicing veterinary medicine. Some might seem rather light-hearted, but others are strong warnings of potential disasters that await us all. The first list comes from my early experiences with Dr. Erwin Small at the University of Illinois, where I received my degree in veterinary medicine, and then at the AMC, where I had the great honor of being taught by men such as Drs. William J. Kay and Steven Ettinger. I assure you I was influenced by many more than just these three colleagues, but they are the ones who informed me and energized me like nothing else in this world. The title 'Mikey's Maxims' comes from a term of endearment that was bestowed upon me in New York by one of my interns, Dr. Max Easom, and which has stuck to me for many years. So, here are 'Mikey's Maxims':

- Treat for the treatable.
- Assumptions lead to trouble; therefore don't assume.
- Always interpret clinical information within the context of the patient's presentation.
- Avoid tunnel vision.
- Treat your patient, not just its disease.
- Avoid overmedicating.
- Be honest with yourself.
- Don't postpone today's urgencies until tomorrow.
- Think that common things occur commonly.
- Look closely at your patient; it will usually tell you what's wrong.
- Never let your patient die without the benefit of the silver bullet.
- When you hear hoofbeats, look for horses, but don't forget about the zebras.
- Never sell the basics short – they are still the best buy in town.

- If you don't think it, you won't find it.
- Never let a biological specimen go to waste.
- Disaster lurks whenever a patient's problem is 'routine'.
- If it's not getting worse, give it a chance to get better.
- Don't stray too far from the patient – the diagnosis will appear eventually.
- Don't give your patient a disease it doesn't deserve to have.
- Don't let technology make you decerebrate.
- The necropsy is the clinician's trial by jury.
- The wisdom of experience should never be ignored.
- The diagnostician should always ask him/herself these two questions: where am I now, and where am I going?
- If the patient isn't going where you expect it to be going, then go back to square one.
- In order to successfully to treat a cat, you must think like a cat.
- Avoid the pitfalls of the red herring.
- If they can't afford a Caddy, then offer them a Chevy.
- Know thy patient.
- Nobody wants to pay for a big bill and a dead animal.
- You must have cognition to be a competent diagnostician
- To prognose, you must first be able to diagnose

Funny as some of these might seem, I promise that each and every one is based on real life experiences and, by offering these to you, I hope that I can spare you a fraction of the 'pain' that I have experienced over the years.

About 8–10 years ago I developed a lecture titled 'Clinical Pearls'. Unlike the Maxims, which are more philosophical, the 'Clinical Pearls' represent valuable lessons in actual practice that have helped me and others to practice better medicine. I never intended for these to be included in this image textbook, but the publisher, Mr. Michael Manson, insisted that they be included in this text. So, bowing to Mike's knowledge and experience with the written word, I have included various lists of 'Clinical Pearls', which, again, I hope will be of great benefit to my fellow practitioners. Some are general in nature and are shown at the end of this Introduction; others are shown at the beginning of the chapter to which they relate. Some of these are written with American slang, which is essential for the maximal effect of my message. I offer my apology to those who might be overly critical of my absence of style.

There are so many people that I want to thank, without whom much of my career would not have been possible. First and foremost is my wife, M.J. (Mary Jane), who has been my faithful companion through thick and thin over the past 33 years of our marriage. Special credit is deserved because living with me under periods of extreme work pressure will never be described as a 'cake-walk'. M.J. is actually the main person who made this book possible because she single-handedly and painstakingly scanned thousands of my slides to allow for me to enter the electronic age of teaching. I might add

that she just did not scan aimlessly; instead she took each slide, cleaned it from its years of wear and tear and made it completely usable for the many years to come. Such saintly patience I could never have, or I probably would have been a brain surgeon instead of an internist! On the home front I thank my children, Andrew and Lauren, for hanging in there with their Dad even though he missed some of the special moments of their childhood, and then back to M.J., who made certain that my work must wait while the Dad was where he was supposed to be for most of those special events.

To my parents, Teddy (deceased) and Bernice, I thank you for teaching me the principles of right and wrong and for providing me with the best college education possible. To my late sister, Marsha, thank you for always sharing in my triumphs and being there when I needed a friend. You left us too suddenly. I miss you.

To my students, I leave my works hopefully for you to benefit from, because it was you who inspired me to keep on with my teaching when everything else around me seemed rather dismal. Remembering those moments of discovery during rounds still brings out the goose bumps, and those looks on your faces when you realized that you could actually practice excellent medicine – priceless.

A special thank you to my colleagues who shared in those moments of learning and who offered me their own excellent wisdom and inspiration in my search of excellence in medicine. Academic medicine is far from a relaxing environment, but at the same time it is the only place where intellectual challenges are made, egos are bruised, and, most importantly, where the art and science of medicine progresses. I only hope that we share mutually in those special moments. I also want to acknowledge my colleagues at the AMC and the University of Florida for allowing me to photograph their cases and to share them with my students, colleagues and the readers of this text.

Last and certainly not least I want to thank Mr. Michael Manson and his wonderful staff at Manson Publishing, located in London, England. What a tremendously gracious gentleman Mike is and what a wonderful intellect he has, which has made him the success that he is today. My final acknowledgment goes to Peter Beynon, who is responsible for converting my rough literary style into one that gives me more credit than I deserve. Thank you, Peter, for doing your 'magic' to make this book the polished finished product that we now have in our hands.

Michael Schaer
Gainesville, Florida

CLINICAL PEARLS

Patient evaluation:

- Pallor can be caused by hypoxia, shock, anemia, and an epinephrine injection.
- Anemic pallor plus icterus causes a yellow hue.
- Pink mucous membranes plus icterus causes a more orange color.
- Massive generalized lymphadenopathy usually means lymphoma.
- If it looks, smells, and tastes (?) like pus, then it must be pus.
- Chest plus abdominal fluid accumulation commonly depicts a bad disease. Common causes: neoplasia, heart failure, diffuse inflammation, hypoproteinemia.
- Septic shock: hypotension, hypothermia, thrombocytopenia.
- Skin turgor is difficult to assess with cachexia and obesity.
- Sudden facial swelling, hemorrhagic oral mucosa, subdued mentation – think Eastern diamondback rattlesnake envenomation (in Florida).
- Various causes of hyperventilation: cardiorespiratory, pyrexia, brain disease, Cushing's, metabolic acidosis, anxiety, pain, shock, anemia.
- Fever plus immune-mediated disease – appetite can persist.
- Fever plus sepsis – anorexia.
- Nasal crustiness, scleral injection, muddy mucous membranes – think uremia.
- On palpation: 'Touch but don't squeeze the Charmin'.
- Take the patient out of the cage and look at it!
- If something is just 'ain't right', think neuro.
- Look under that tongue in any vomiting cat (and dog).
- Watch those hindlimbs for the earliest sign of weakness.
- The **big** 6: PCV, TP, BUN, glucose, urine analysis, chest/abdominal radiographs.
- After therapeutic pericentesis, go back and repeat abdominal palpation so you don't pass the mass.
- Have you been palpating each mammary gland?
- A lump is a lump until you stick it.
- It's all in the history.
- Don't just look at it (a lump) – stick it!
- Heat stroke >43°C (>109.4°F) – look out for DIC.

Fluids and electrolytes:

- SC fluid administration – isotonic, 18 gauge needle, gravity flow.
- Metabolic alkalosis plus hypokalemia common with upper GI obstructions.
- 0.9% NaCl plus KCl – best for upper GI obstructions.
- TCO_2 >40 mmol/l is always metabolic alkalosis (usually with hypokalemia).

- TCO_2 < 10 mmol/l usually means severe metabolic acidosis.
- Potassium penicillin contains 1.7 mmol K+/million units – take heed when bolusing.
- Treatment for hypocalcemia when IV not an option: add 2.5 ml/kg 10% calcium gluconate to 150 ml 0.9% NaCl – give SC q12h (for adult sized cat).
- When giving SC fluids avoid hypokalemia – add 3.5 mmol KCl/150 ml lactated Ringer's solution – give SC (for adult sized cat).
- All IV maintenance fluids should contain 7–10 mmol KCl/250 ml; exceptions are oliguria and untreated Addisonian.
- To make up 2.5% dextrose solution increments, add 12.5 ml of 50% dextrose in water to 250 ml of fluids.
- Rehydrate before inducing diuresis; check urine SG first.
- Volume load with isotonic crystalloid.
- Intraosseous cannulas can be life saving.

Drugs:

- Observe for drug interactions.
- Do not use theophylline with ciprofloxacin – causes theophylline OD.
- Best avoid IV route for thiamine (better IM) and vitamin K1 (better SC).
- Rehydrate prior to using aminoglycosides.
- Prednisone for craniomandibular osteopathy.
- Cimetidine enhances metronidazole-induced neurotoxicity.
- Aspiration pneumonia worse when H_2 blockers in use.
- Panmycin in cats can cause fevers.
- For anaphylaxis give epinephrine (0.01 mg/kg) IM and repeat every 15–20 minutes until stable.

Patient management:

- Old dogs are poorly tolerant to tranquilization.
- Avoid sedating acutely ill patients unless absolutely necessary.
- Don't sedate at the end of the day.
- Increased spontaneity might preempt death.
- Heparinized syringe might contain as much as 200 units heparin – too much for puppies and kittens.
- Traumatic ear flush can cause inner ear and vestibular disease.
- Cats hate atropine drops (use ointment instead).
- Some pathologic bladders can leak after cystocentesis.
- Do not forget **thiamine** in cats.
- Glycerine suppositories for patients with pelvic fractures will be most appreciated!

- Three milligrams (total dose) ketamine IV – can adequately restrain the sick cat with urethral obstruction.
- Careful with SC fluids – dogs are not cats, and they like to slough!
- Manual expression of a male dog's bladder is hazardous to its health – it can rupture.
- SC fluid administration – stay behind the scapula and in front of the wing of the ilium. Use 18 gauge needle and 50 ml/site (adult cat).
- Don't forget glucose for the babies.
- Imipenem for life-threatening infections.
- A clean cat is a happy cat.
- No Fleet enemas (high phosphate, high sodium-containing enema solution) for obstipation, unless you want to treat a good case of hypocalcemia.
- When is the last time you hugged your patients?
- A dynamic duo: good science and experience.
- Heat lamp and rubbing alcohol = one **hot** dog.
- Nothing is routine.
- Body bandage in cats cause pseudoparalysis.
- Rapid abdominocentesis is effective and safe for chronic ascites, except when it is due to liver disease. With the latter it is best to go slower and simultaneously administer IV plasma.
- Best avoid IV B1 and K1 – give SC or IM.
- Never 'kill'em' based on cytology results.
- Treat anaphylaxis eith epinephrine, IV fluids, H_1 and H_2 blockers, and glucocorticoids (for delayed benefit).

1

Dermatologic disorders

DERMATOLOGY is derived from the Greek term ***derma***, meaning skin, and ***logos***, meaning study or speech, word, or reason. It is an essential discipline for the practitioner because of the high incidence of skin disease that one can encounter daily in practice. These disorders can occur as primary lesions or syndromes or they can be a reflection of some other internal disease process in the body. Adherence to the essentials of obtaining a complete history and doing a complete physical examination will be most helpful in determining the cause of the dermatologic disorder. Perhaps the most common group of skin diseases involve hypersensitivity states, but other important conditions might be associated with autoimmune disorders, infectious diseases, neoplasia, nutritional disorders, and various metabolic and endocrine conditions. The diagnostic methodology of skin diseases, after taking a complete history and conducting a physical examination, includes general tests such as a complete blood count, serum biochemistry profile, immune or infectious disease serology, skin hypersensitivity testing, and biopsy. The advantage of these tests is that they are readily available to the practitioner and noninvasive for the patient. In many instances the classic appearance of certain lesions will allow for a minimal diagnostic evaluation, thus saving the owner a substantial amount of expense.

◀ Eosinophilic granuloma complex in a cat.

1

Dermatologic disorders

- A lump is a lump until you look at it under the microscope.
- Don't look at it – stick it.
- Skin turgor difficult to assess with obesity and cachexia.
- Excessive SQ fluids can cause sloughed tissue.

1 Puppy strangles. Otherwise known as juvenile cellulitis, this condition affects puppies four weeks to four months of age. Antibiotic drugs are virtually ineffective in controlling this condition; glucococorticoids are the drug of choice for this presumed hypersensitivity skin condition.

2 Alopecia X.
This Pomeranian has the typical skin abnormalities of alopecia and hyperpigmentation that was once blamed on growth hormone deficiency. Further research has shown that growth hormone blood levels can be normal in many of these dogs, and that the syndrome can be associated with various other causes including sex hormone abnormalities.

3a–c Cheyletiella mange. Examination of this very pruritic rabbit (**3a**) revealed 'walking dandruff' (**3b, c**), which was actually the moving mites. This condition is easily diagnosed, with a microscopic examination of a skin scraping sample showing the large mite. Pyrethrin powder can be used to treat this parasite, but do not use permethrins because of the adverse side-effects that can occur in rabbits and cats with these compounds.


3a

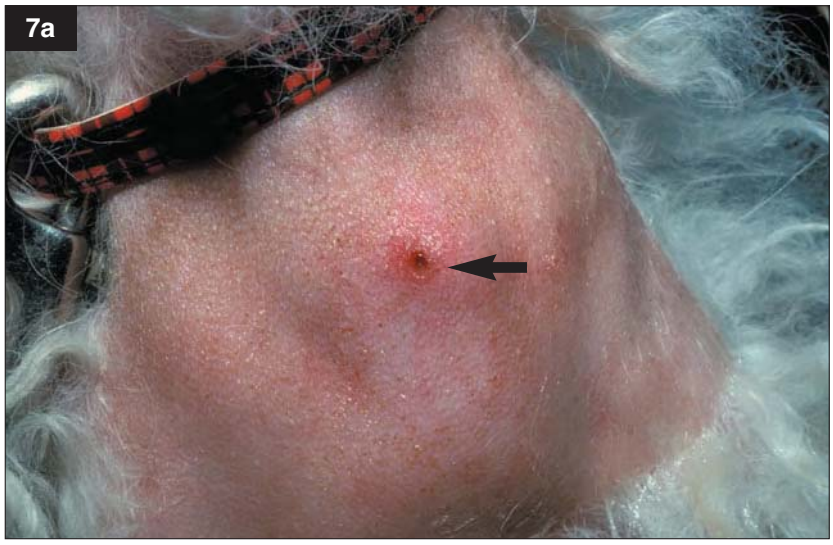

3b


3c

4a, b Calcinosis cutis. This dog (**4a**) had pituitary-induced hyperadrenocorticism (PDH) and the characteristic inflammatory form of calcinosis cutis. Note the mineralization in the close-up view of the axilla (**4b**). Despite the inflammation, glucocorticoid drugs should not be used because these drugs will only worsen the condition.

5a, b Calcinosis cutis from calcium gluconate. These two images show severe debilitating calcinosis cutis caused by a calcium gluconate injection that was given sub-cutaneously to a young Australian Shepherd Dog to treat its hypocalcemia, which was caused by primary hypoparathyroidism. Image **5a** was taken during the early phase of the condition, and image **5b** was taken 1 week later. Despite what the veterinary literature states, calcium gluconate solution is irritating to tissues and should, therefore, be injected into a large vein.

6a, b Angioneurotic edema. This young Dachshund acquired angioneurotic edema and urticaria shortly after being vaccinated. This is a type 1 hypersensitivity reaction that responds to antihistamine and glucocorticoid therapy, and time. It usually does not progress to more life-threatening signs, but the patient should best be examined anyway.



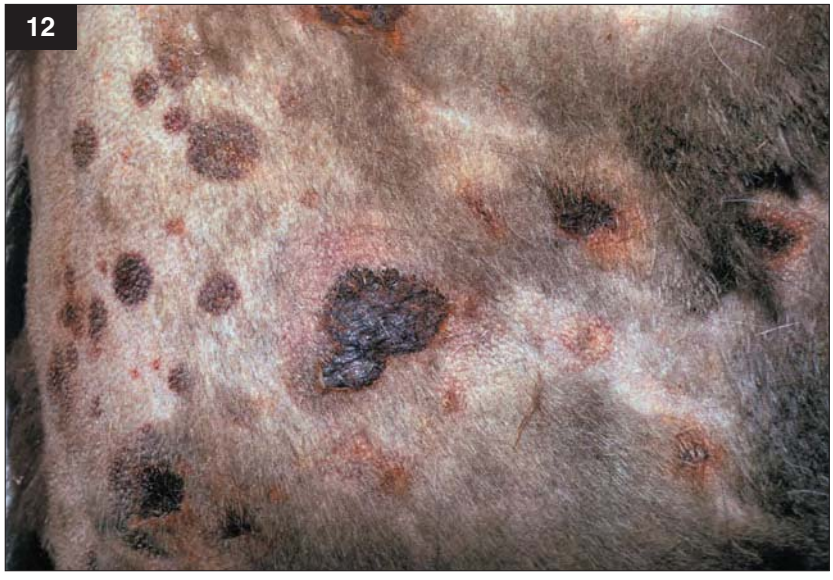
7a, b Cuterebriasis.
Cuterebra species flies will sometimes deposit their eggs directly onto a dog's skin, which allows the larvae to burrow into the skin and cause the typical granuloma-containing 'blow-holes' (**7a**). This larva was carefully extracted, at the same being cautious not to crush it while it was in the skin (**7b**). Also described in case **408**.

8 Contact dermatitis.
This Abyssinian cat sat in kerosene and acquired acute contact dermatitis.
The cat's frequent licking worsened the inflammation.
Antiinflammatory drugs and the use of an Elizabethan collar would be indicated for treatment.

9a, b Fire ant bites.
This young Weimeraner laid down next to a fire ant nest and was swarmed by these wingless, stinging hymenopterans (**9a**). The lesions are papular at first and then develop a central suppurative core, which is evident by the 'white heads' (**9b**). Treatment consists of ant removal, antihistamine and glucocorticoid drugs, and good general patient care. Intravenous fluids might be necessary; antibiotic use is discretionary (also described in case **393**, p. 282).

10 Kerion.
This focal dermatophyte lesion on the tail of a dog has a granulomatous character. It is usually caused by *Microsporum gypseum* and is most often located on the face and limbs. Diagnosis and treatment are the same as for any other dermatophyte infection. Treatment includes clipping the area and topical and oral antifungal drugs.

11a, b Linear granuloma.
A compulsive licking disorder might be a strong factor toward the development of this cat's bilateral skin condition. Treatment entails the cessation of any particular triggers that might stress the cat, in addition to drugs used for behavior modification.



12 Sepsis.
These dark pigmented skin lesions were associated with *Pseudomonas* species bacteremia that involved the end arterioles of the skin blood vessels as well as other major organ systems. Microscopic evaluation of the skin lesion demonstrated the infecting organisms.

13a, b Toxic epidermal necrolysis.
This is a young Shi Tzu with severe epidermal ulcerations and skin slough characteristic of toxic epidermal necrolysis (TEN). It usually occurs following some viral disease or it can be a complicated adverse drug reaction. Treatment requires discontinuing any suspected drug and commencing meticulous patient care, which might involve medicated dips, judicious debridement, and, sometimes, antimicrobial treatment for any secondary bacterial infection.

14a, b Hyperelastosis cutis. This kitten has a congenital collagen disorder that has caused hyperelastic skin (**14a**), which can easily tear with routine venipuncture (**14b**). Such affected cats require repeated wound repair, which can be quite difficult because the actual suture needle insertion can cause further tears.

15 Dermatophytosis. Ringworm in the cat has a variety of clinical features. This particular cat showed signs of inflammation in addition to the dry alopecia type of skin lesion. ***Microsporum canis*** is the common causative agent in the cat.

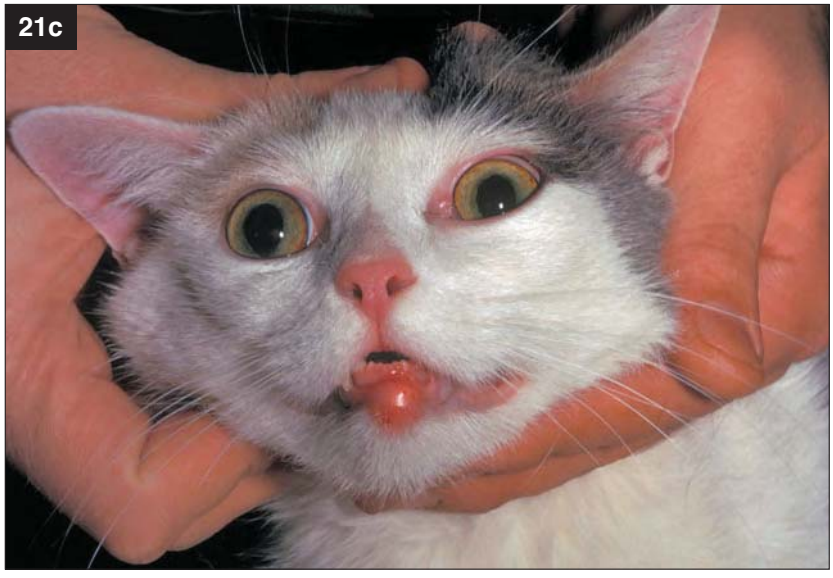
16 Pythiosis.
Once thought of as a fungal organism, this algae-like infection is more common in the dog than the cat. It can be cutaneous or systemic, with each form having a guarded to grave prognosis. Shown here is involvement of the pectoral skin area. Radical surgical removal of the involved body part is often necessary before the lesion becomes too big to resect.

17a, b Pythiosis.
This dog has a more severe form of pythiosis that involves its posterior thigh (**17a**) and the ventral venous tributaries (**17b**). It had invaded the deep pudendal blood vessels, thus making complete resection impossible.

18a, b Nodular panniculitis. The nodular draining skin lesions in this English Setter characterize the immune-mediated skin disorder, nodular panniculitis. The fluid draining from the lesions is opalescent and contains fat droplets. Fever and malaise commonly occur. The condition is responsive to glucococorticoid treatment, which might have to be maintained at low doses for a protracted period of time (2–9 months).

19 Rhodococcus species infection. This bacterial infection is common in horses. Cats that share common environments with horses can also acquire this ulcerative draining skin infection, which can be confused with atypical mycobacterial infection. This particular infection responded well to azithromycin antimicrobial treatment.

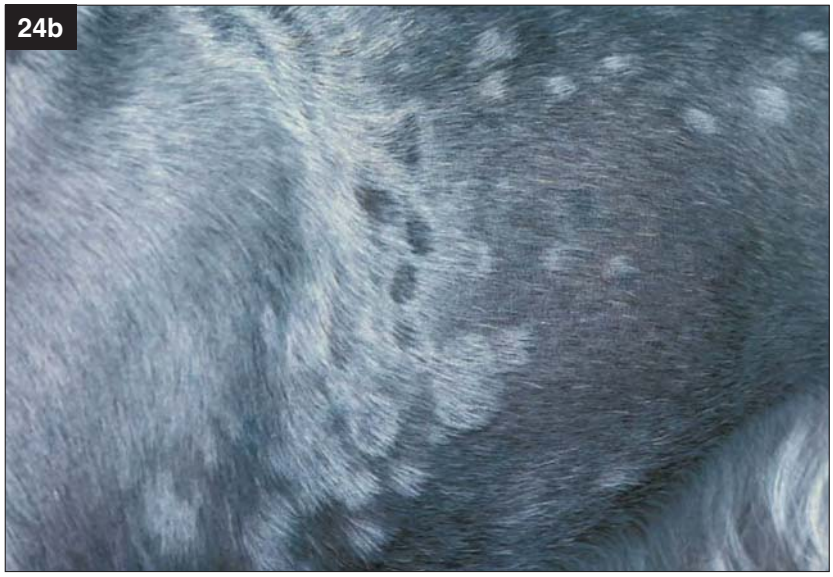
20a–c Pemphigus vulgaris. This Dachshund has pemphigus vulgaris, one of the autoimmune bullus-forming skin disorders. Typical are the mucocutaneous ulcerations, acanthocytes on a skin scraping, and a positive indirect immunofluorescent antibody test result. A guarded prognosis accompanies the large doses of required immunosuppressive treatment.



21a–c Eosinophilic granuloma complex. The cat in **21a** and **21b** has three different lesions involving the chin, palate, and tongue. The cat in **21c** has a solitary lesion on its chin. The exact cause is still unknown; treatment options are described in case **23**.

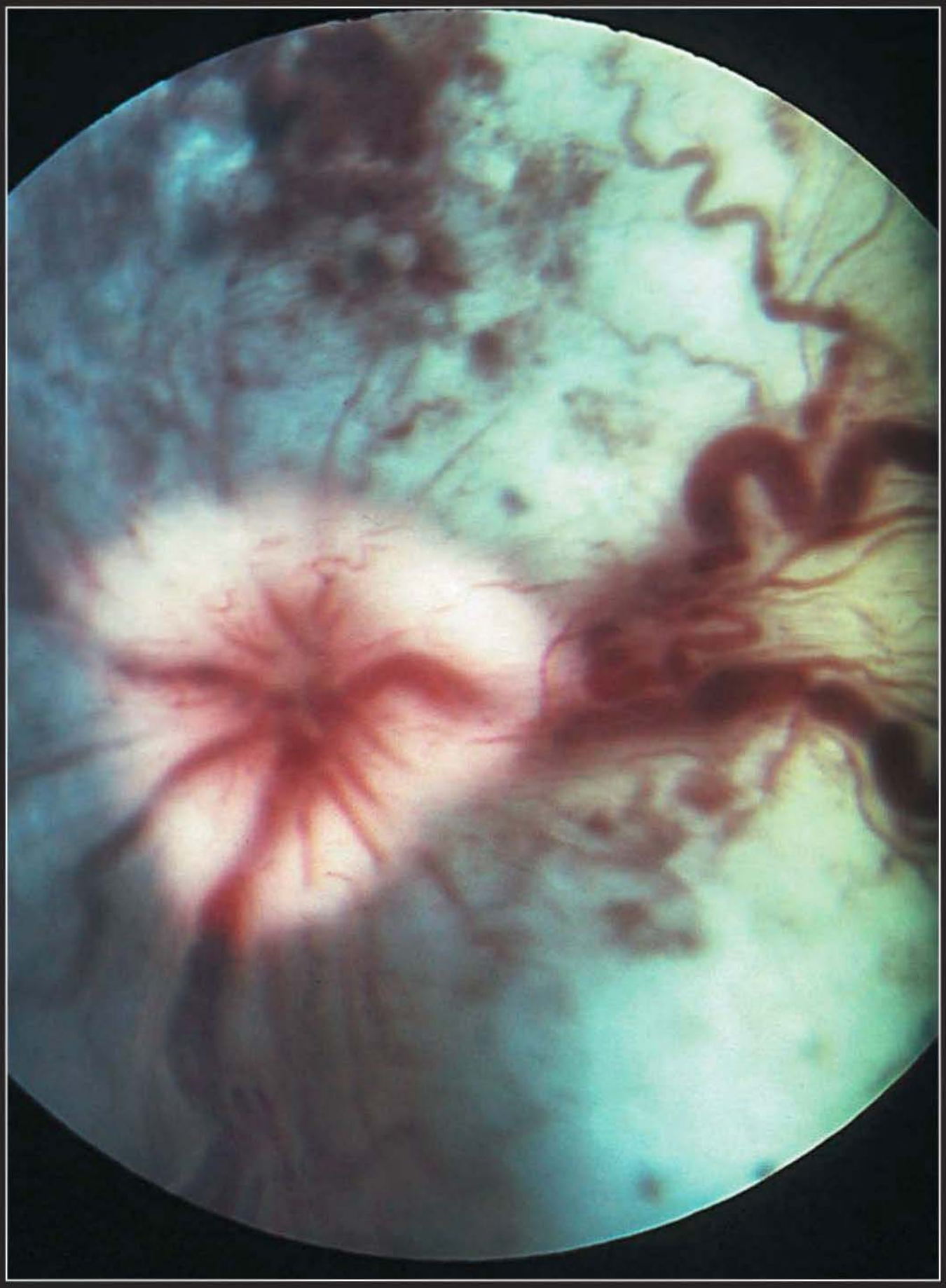
22a–c Eosinophilic granuloma complex.
This syndrome causes various types of lesions in the cat. Shown are a granuloma on the tongue (**22a**), an ulcer form involving the lip (**22b**), and a plaque form involving the caudal thigh (**22c**).

23 Eosinophilic granuloma complex.
This cat shows extensive lip involvement. Treatments vary amongst glucocorticoids and other immune-modulating drugs, diet change, antibiotics, alpha interferon, and megestrol acetate (no longer recommended). The etiology is still unknown.



24a, b Urticaria in Schnauzers.
Urticaria (hives) is commonly caused by a hypersensitivity reaction accompanied by pruritis. Some Schnauzer dogs are predisposed to this lesion, but the cause is not always evident.

25a, b Scabies.
Sarcoptic mange is a common cause of intense pruritis in dogs. This Beagle puppy has a characteristic ear itch reflex on tactile stimulation (**25a**) and papular dermatitis (**25b**). A deep skin scraping can demonstrate the mite and/or its eggs. Sometimes this discovery requires several repeated attempts.



2 Ophthalmologic disorders

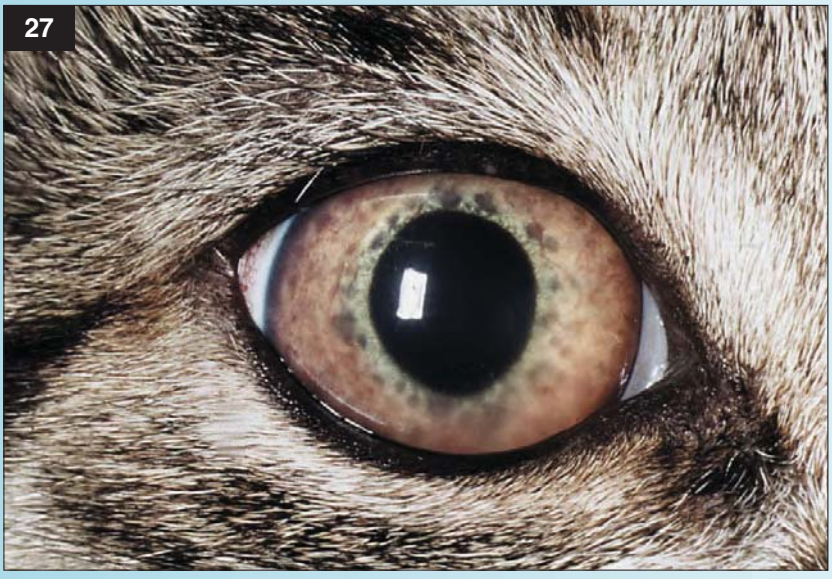
OPHTHALMOLOGY is derived from the Greek word ***ophthalmos***, which refers to the eye. Disorders of the eye occur as primary entities or they can be manifestations of some other disease elsewhere in the body. The eye is sometimes referred to as the 'window to the body', because it allows a direct visualization of pathology that might have its origin elsewhere in the body. The clinician should have a basic understanding of diseases of the anterior and posterior segments of the eye and a basic understanding of direct and indirect ophthalmoscopy. The lesions identified might very well be the first step to obtaining an expedient and accurate diagnosis. Some of the images found in this section would not have been possible without the gracious assistance of the ophthalmology section at the University of Florida, College of Veterinary Medicine.

2

Ophthalmologic disorders

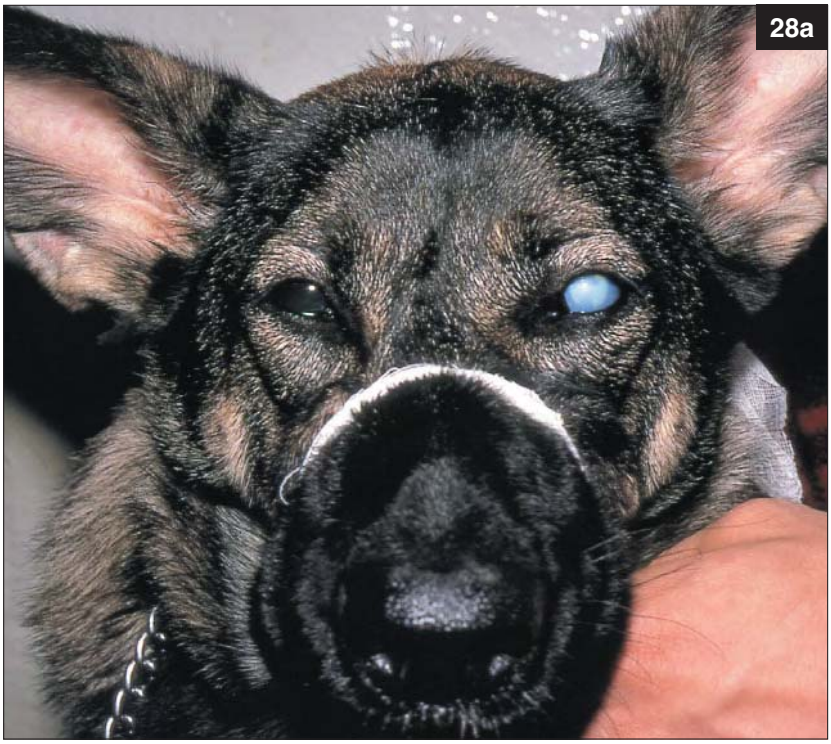
- The eye is the window to the patient.
- A fundoscopic examination should be done on every sick patient.
- Atropine eye drops are very irritating to the cat's oral cavity, therefore only use atropine eye ointment.
- Retinal hemorrhage is a common sign in hypertension.

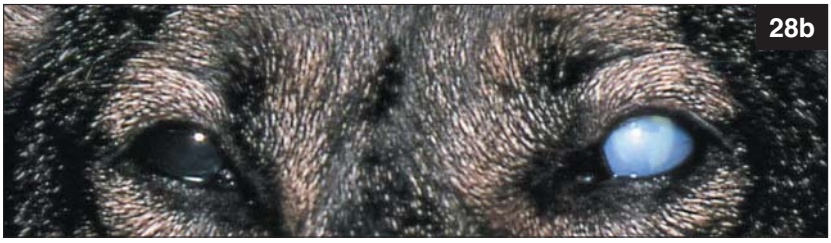
26 Everted 3rd eyelid.
The 3rd eyelid is folded over in this Great Dane puppy because of a congenital predisposition where the posterior portion of the cartilage grows faster than the anterior portion. Surgery is necessary to correct this problem.



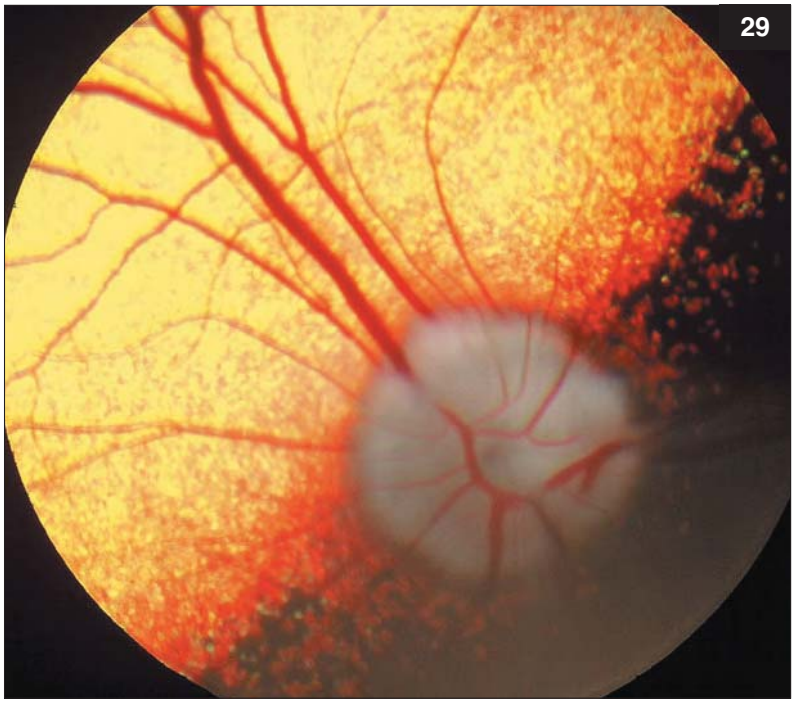
27 Anterior uveitis in a cat.
The discolored and edematous iris illustrates uveitis in this cat. General causes include infectious and immune disease, trauma, and neoplasia. Toxoplasmosis is one of the common infectious diseases associated with uveitis. The cause is frequently unknown.

28a, b Anterior uveitis.
This serious ocular disorder can occur as a primary disease or it can be only one sign of another disorder, including various infectious, autoimmune, and neoplastic diseases. The German Shepherd Dog shown demonstrates the classic 'hepatitis blue eye' that sometimes occurred as an adverse drug reaction to the canine hepatitis vaccine of years past.

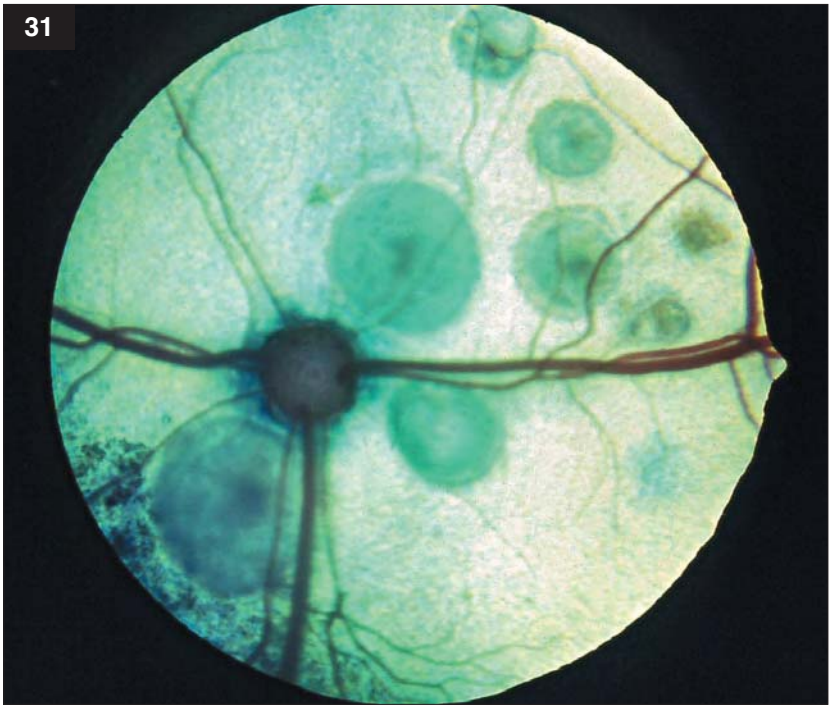




29 Normal fundus.
Becoming acquainted with the appearance of the normal canine fundus is the first step to learning what is abnormal. This same rule applies to all other organ systems as well.



30 Cataract.
This cataract in a diabetic dog would typically form rapidly. Diabetic cataracts usually occur in bilaterally. They rarely, if ever, occur cats because of their more efficient glucokinase enzyme system, thus preventing the polyol (sorbital) pathway from becoming activated in the lens.



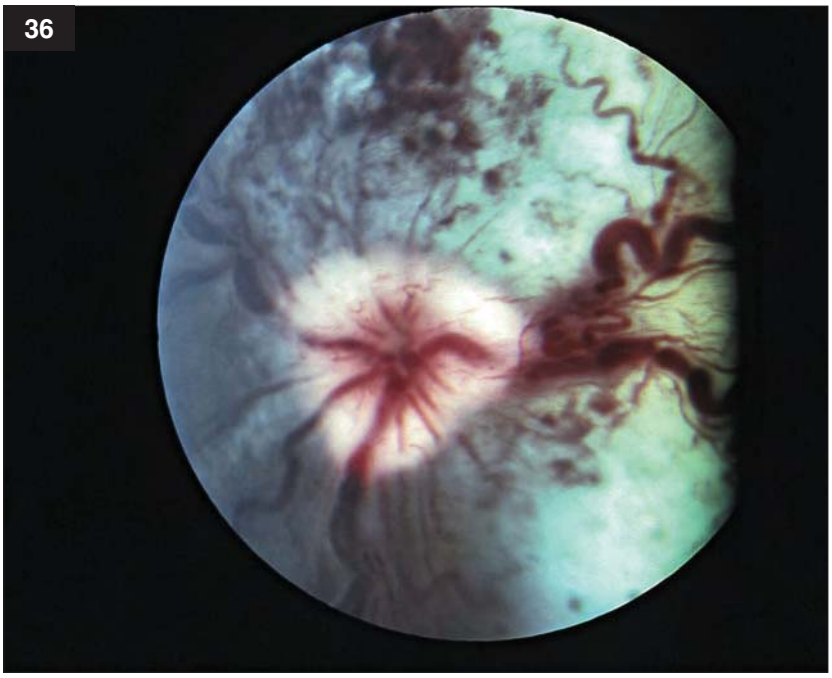
31 Chorioretinitis.
These retinal granulomas belong to a cat infected with cryptococcosis. Chorioretinitis in the cat can also be caused by several different medical disorders, including various fungal infections, toxoplasmosis, and feline infectious peritonitis.

32 Corneal ulcer perforation.
The unfortunate progression of events in this kitten were upper respiratory virus infection, conjunctivitis, keratitis, corneal ulcer, and then perforation. The left eye would probably require enucleation; the right eye might require the same in the future as well.

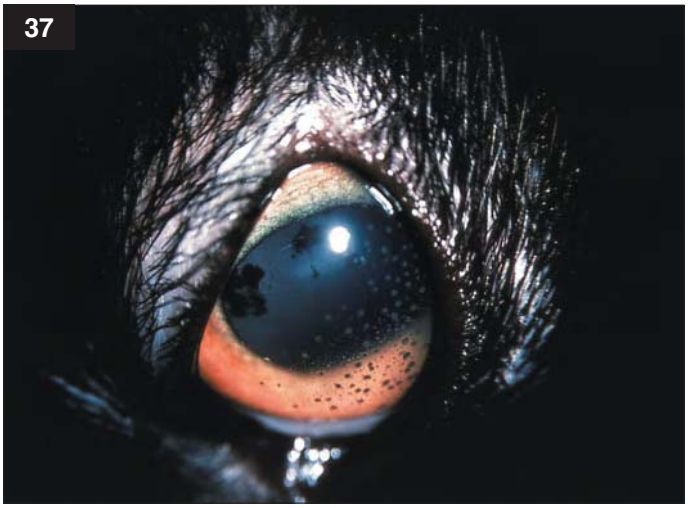
33 Conjunctivitis.
This kitten has viral ophthalmic disease causing bilateral conjunctivitis, keratitis, and corneal ulcers.

34 Corneal cholesterol deposits.
There are several causes of hyperlipidemia in the dog. Hypercholesterolemia is one subtype. Hypercholesterolemia might accompany any one of several metabolic conditions including hypothyroidism, which can cause hyperlipidemia. (Image courtesy University of Florida Ophthalmology Service)

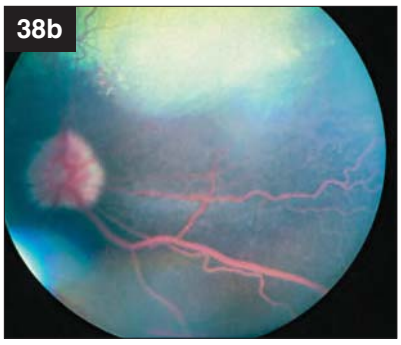
35 Dendritic ulcer and keratitis.
Note the faintly stained dendritic ulcer as well as the aqueous flare on this cat's cornea. The dentritic ulcer appears as a fluorescein-stained branching lesion in the center of the cornea. (Image courtesy University of Florida Ophthalmology Service)



36 Hypermacroglobulinemia. This paraproteinemia can cause blood hyperviscosity and coagulation abnormalities. The accompanying retinal changes include segmented 'sausage-shaped' blood vessels and retinal hemorrhages. Lethargy is a common clinical complaint because of the sluggish blood flow to the brain.



37 Keratic precipitates. The deposits on this cat's cornea are keratic precipitates, which typically can occur with feline infectious peritonitis. Elevated immunoglobulins (polyclonal gammapathy) can occur with this clinical disorder. (Image courtesy University of Florida Ophthalmology Service)



38a, b Lipemia retinalis. Hyperlipemia can cause the retinal blood vessels to appear white. Some of the common causes of hyperlipidemia are hypothyroidism, familial hyperlipidemia of Schnauzers, hyperadrenocorticism, and diabetes mellitus. Certain congenital disorders are associated with deficient lipoprotein lipase. (Image courtesy University of Florida Ophthalmology Service)

39a, b Lid agenesis.
Lid agenesis could easily predispose this young cat to various types of ocular trauma. Surgical lid construction is the only possible option.

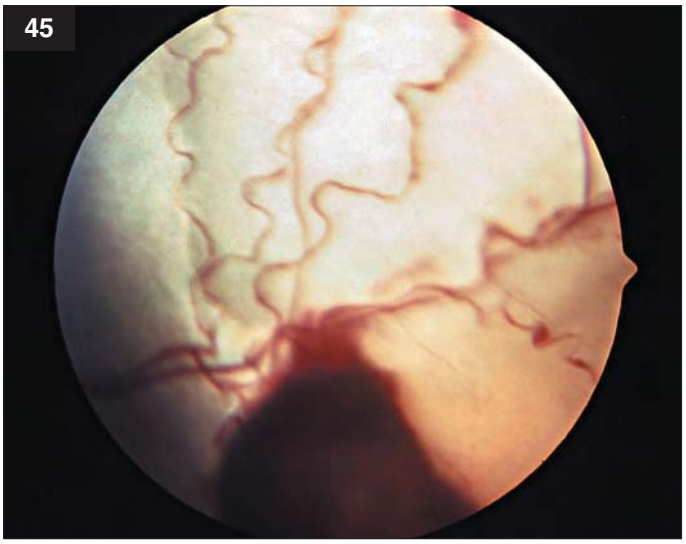
40 Anterior uveitis.
This dog has anterior uveitis without corneal edema, thus allowing the examiner a better look at the uveal tract. Note the 'muddy' appearance to the iris and the scleral injection.

41a, b Microphthalmia.
These two kittens have microphthalmia, a congenital eye disorder that is accompanied by several other ocular maldevelopments such as cataract, anterior segment abnormalities, and retinal dysplasia.

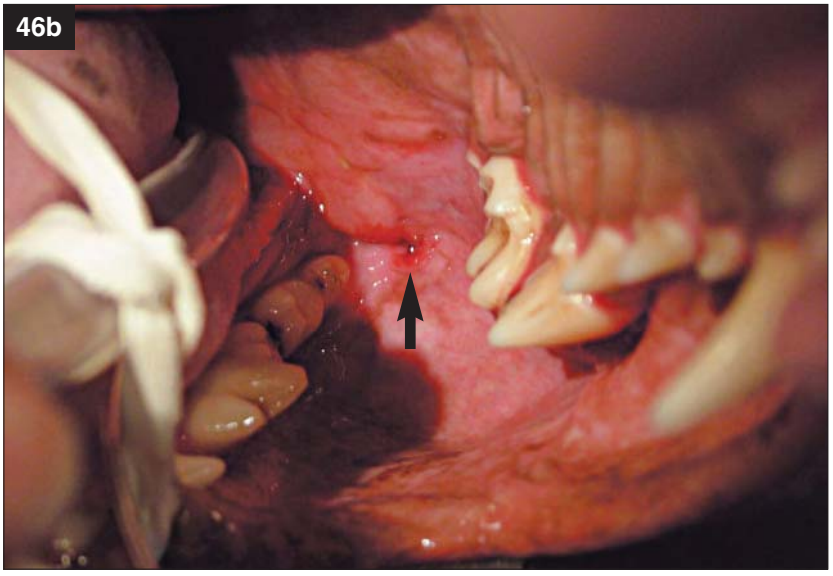
42 Papillitis.
Papilledema is another term for this disorder, which is characterized as inflammation of the optic papilla. The actual condition is the reason for the blurry image.

43 Ocular lymphoma.
This neoplastic condition can take on many forms. Here the cancer originated in the conjunctiva and covered the dog's entire eye.

44a, b Iris cysts.
The main differentials for the black growths in this Abyssinian's eyes are uveal cysts and melanoma. Uveal cysts are free floating and they will transilluminate light.



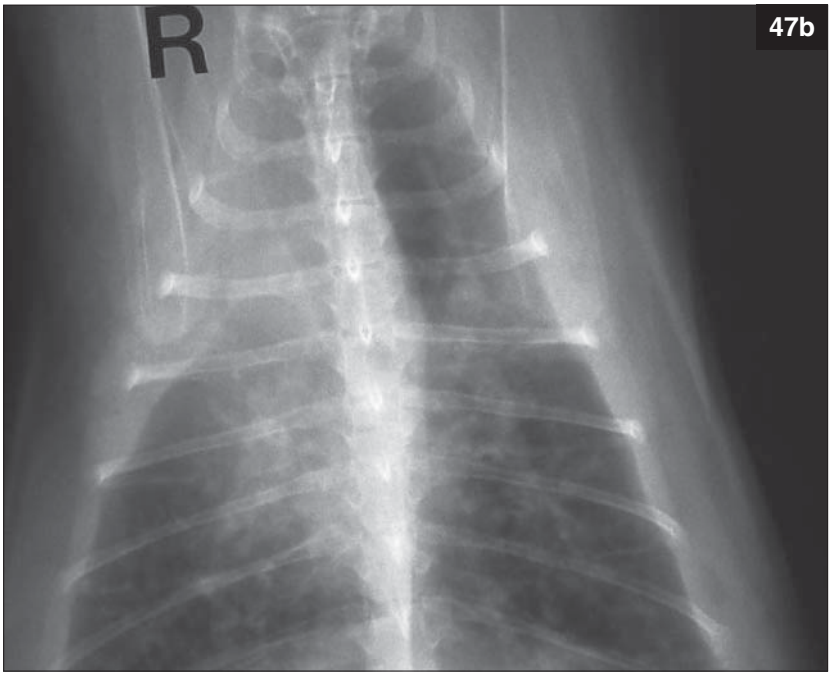
45 Retinal hemorrhage.
Retinal hemorrhage in the cat can have many different etiologies. The most common cause is hypertension with or without underlying renal dysfunction, coagulation disorders, trauma, hyperthyroidism, and feline leukemia virus infection.



46a, b Retro-orbital cellulitis: abscess.
This dog's painful retro-orbital cellulitis was caused by a suspected foreign body that had penetrated caudal to its last upper molar tooth. The foreign body was not found.

47a, b Pancoast's syndrome. This syndrome occurs in humans and animals. It is caused by a right apical lung tumor that has invaded the surrounding area and interfered with the sympathetic nerve fibers (rami communicantes) alongside the anterior thoracic vertebrae, thus causing a Horner's syndrome (miosis, ptosis, and enophthalmos). An affected cat with a right-sided Horner's syndrome is shown (**47a**), together with a ventrodorsal radiograph showing the right apical lung tumor (**47b**).


47a



47b

3

Infectious diseases

INFECTIOUS is derived from the Latin word ***fectus,*** meaning corrupt or infect. This group of disorders is a constant challenge to the clinician, because a timely diagnosis can often bring about a timely treatment, which can strongly influence the patient's prognosis. There are many infectious diseases of the dog and cat, but only a small portion will be illustrated in this section. Although the physical characteristics of certain infections are highly characteristic of that particular disorder, it is strongly recommended that supportive diagnostic tests such a culture and sensitivity, biopsy, and serology be used to confirm any clinical suspicions. With the widespread availability of today's modern day transportation modalities, a thorough geographic and environmental history is an essential component in the accurate diagnosis of many of the disorders that follow.

◀ Calicivirus in a cat.

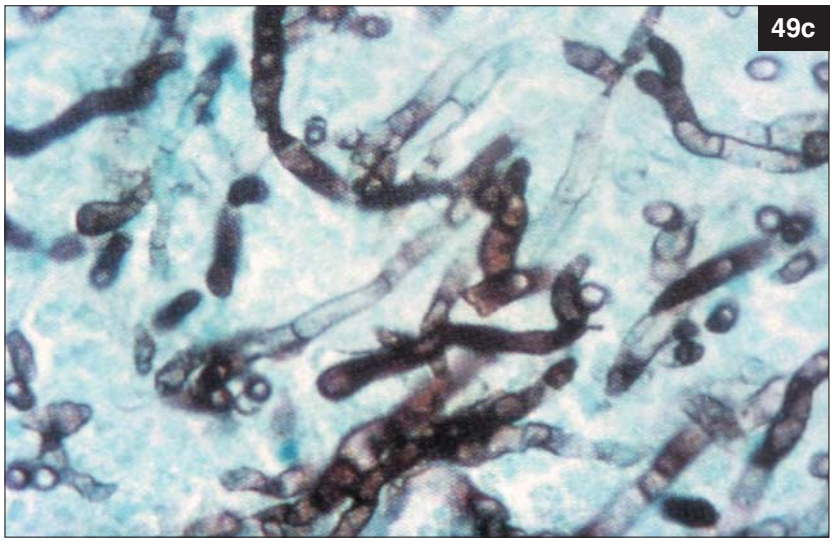
3

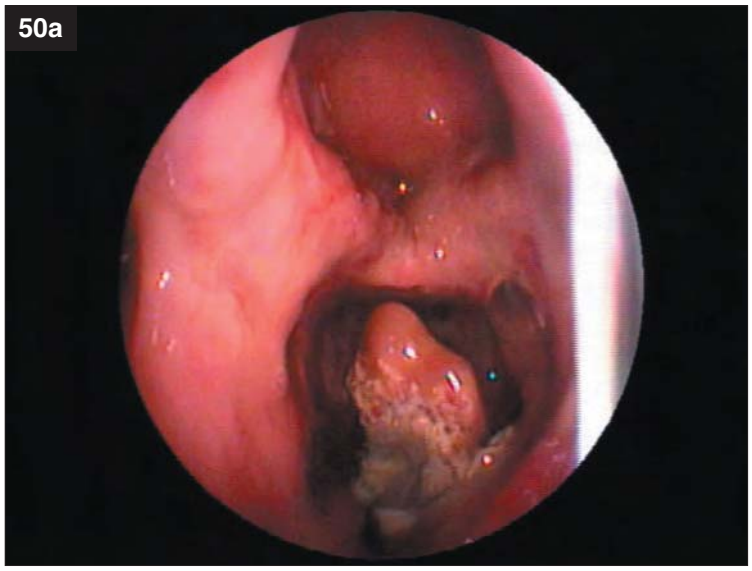
Infectious diseases

- Use the strongest antibiotic for the most persistent and life-threatening bacterial infections.
- Patients in septic shock can be afrebrile and have hypotension and thrombocytopenia.
- Fever has several different causes: infection, hyperimmune reaction, autoimmune disease, cancer, necrosis, drug reaction.
- Pneumonia with leukopenia can cause minimal radiographic signs.
- Immunocompromise can predispose to fungal infection.

48 Anal sac abscess: cat. Although anal sacculitis is common in dogs, it can also occur in the cat and progress to a draining abscess. Treatment is the same as in the dog, calling for incisional drainage of the abscess along with expression of the sac contents, which in this cat was a grey colored inspissated material, as shown in the image. Further treatment would consist of hot packing and antibiotics.

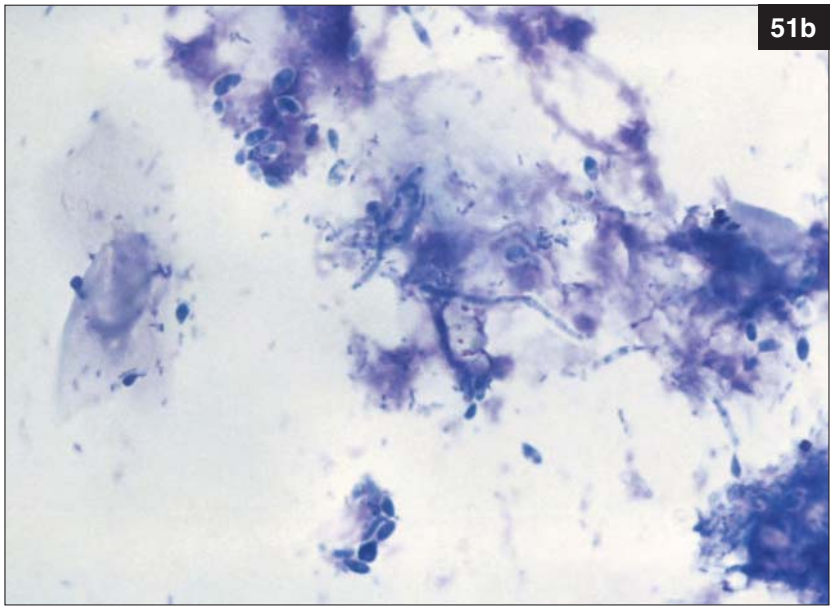
49a–c Aspergillosis.
Focal nasal and sinus infections caused by ***Aspergillus fumigatus*** are fairly common in the nasal and sinus regions of dogs in certain parts of the world. This dog had severe involvement that caused necrosis and sloughing of the nasal bone (**49a**). Prior to the fungal infection the dog had a nasal adenocarcinoma, which was treated with surgery and radiation. It was then complicated by the ***Aspergillus*** infection. The defect was successfully managed surgically and medically (**49b**). A photomicrograph of the fungal hyphae is shown (**49c**).

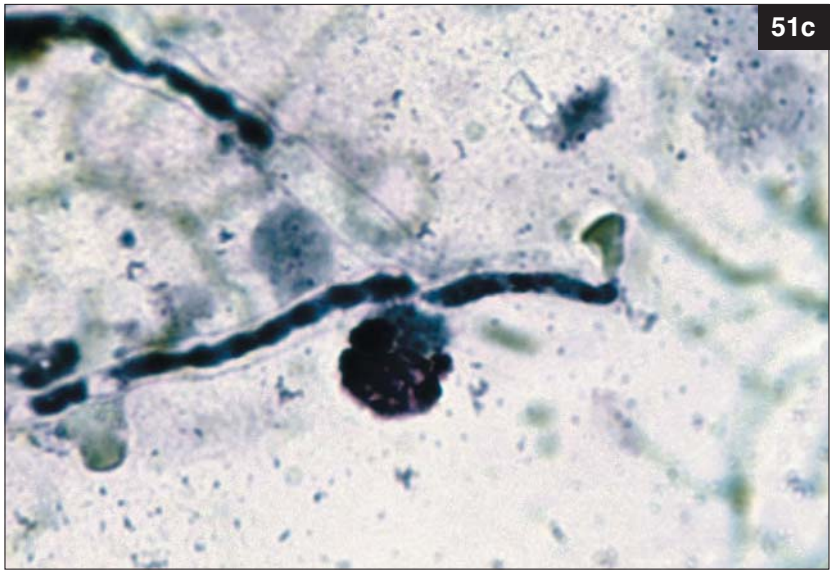




50a–d Aspergillosis. Rhinoscopic views of a dog infected with nasal aspergillosis are shown (**50a–c**). Fungal granuloma and white fungal plaques consisting of thousands of ***Aspergillus*** species organisms are illustrated. Treatment includes local installation of clotrimazole or enilconazole. Surgical resection of infected tissue is sometimes needed in refractory cases. The surgical view, in a different dog, depicts a fungal granuloma inside the nasal cavity (**50d**). This was readily visible after the nasal bone flap was removed.

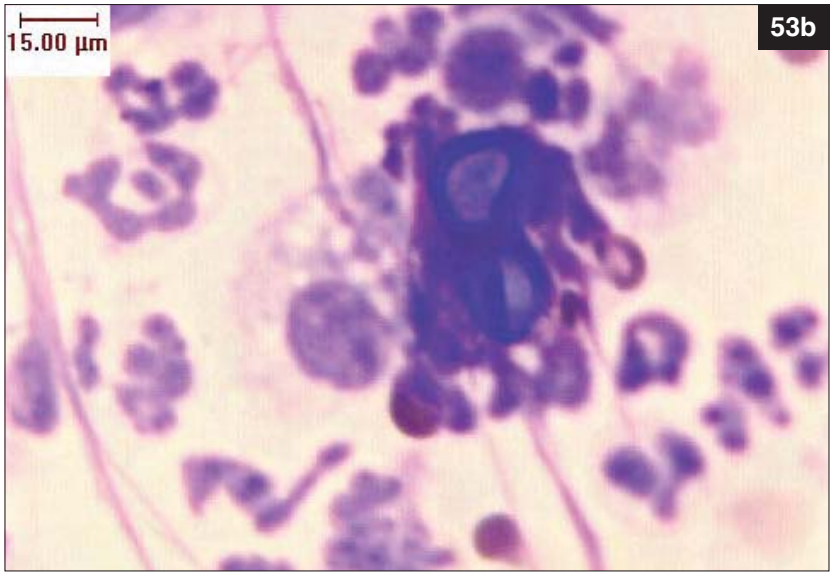
51a–c Aspergillus diskospondylitis. Systemic disease cause by *Aspergillus* species is a very debilitating illness in the dog. It can typically cause diskospondylitis and fungal pyelonephritis, as well as affect other tissues. The image of the vertebral bodies and end plates illustrates the osteomyelitis and diskitis that occurs (**51a**). Urine sediment evaluation can detect fungal hyphae, as shown in **51b, c**, providing evidence of renal involvement. ***Aspergillus terreus*** is a common cause of this systemic form of disease, which has a predilection for the German Shepherd Dog and has a guarded to grave prognosis.



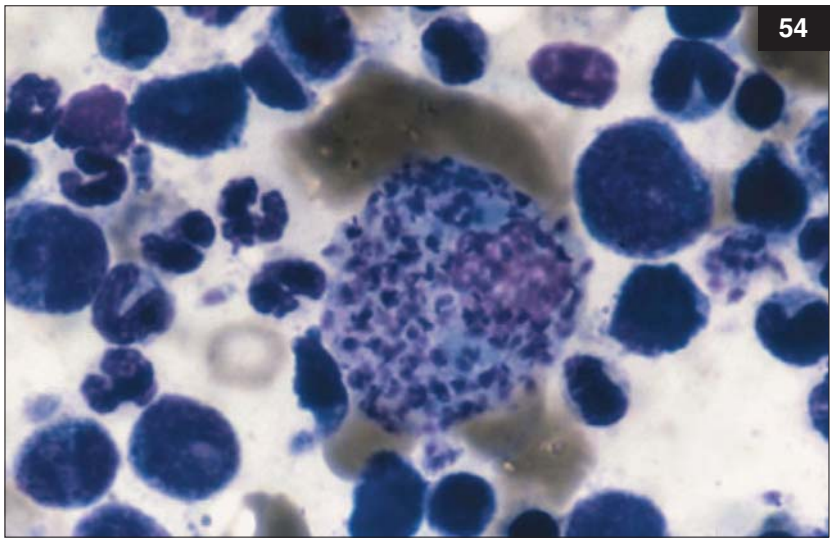


52a–c Atypical mycobacteria.
This infection in the cat commonly occurs in the flank and ventral abdominal regions (**52a, b**) and is characterized as inflammatory with fistulous tracts. Biopsy for histopathology and microbial isolation is recommended for diagnosis. The organisms will stain with acid fast (**52c**) and they require special culture media for bacterial isolation. Surgical resection of the infected tissue is hardly ever successful because of incomplete removal and a high incidence of reoccurrence. Long-term, culture-specific antimicrobial treatment usually extends to one year or beyond. (Image 52c courtesy University of Florida Clinical Pathology Service)

53a, b Blastomycosis: cutaneous.
Blastomycosis is known more for its systemic involvement. The dog in this image had skin involvement in the form of ulcerated nodules (**53a**) and probably systemic involvement as well. The fungal organism was readily visible with fine needle aspiration and cytology (**53b**). (Images courtesy University of Florida Clinical Pathology Service)

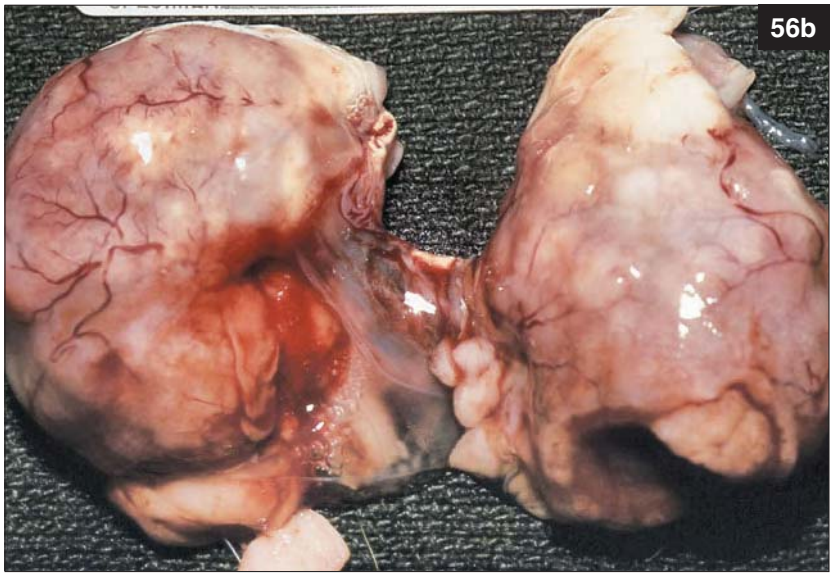


54 Leishmaniasis.
This bone marrow aspirate is from a Golden Retriever that had chronic epistaxis, periodic fevers, and splenomegaly after it had moved from Crete to the United States. The macrophage contains the amastigotes of *Leishmania* species. (Image courtesy University of Florida Clinical Pathology Service)



55a–c Calicivirus.
This Siamese cat (**55a**) shows ocular signs of this common upper respiratory infection. The virus is also known to cause a polyarthritis in cats, which is apparent in this patient, with the guarded posturing indicating its discomfort (**55b**). The clinical joint disease is evident in this cat, with readily visible swelling (**55c**). The polyarthritis is self-limiting and lasts for only a few days.

56a–c Feline infectious peritonitis (FIP). Renal pyogranulomas associated with FIP can occur with either the 'wet' or 'dry' forms. Severe renal parenchymal involvement can lead to renal failure. A definitive diagnosis can only be made with histopathology of selected tissue specimens. Shown are postmortem specimens illustrating gross pyogranulomas (**56a, b**) and a more subtle granular type of pyogranuloma (**56c**).

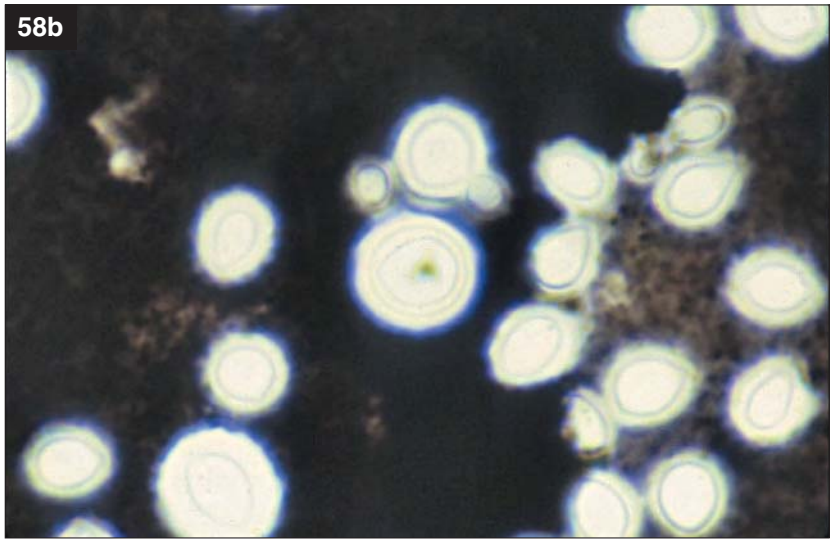


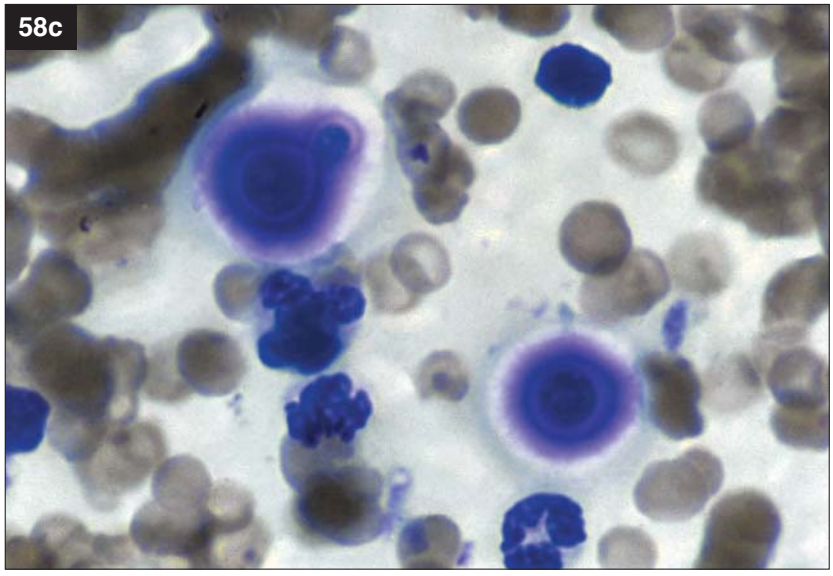
57a–g Cryptococcosis. *Cryptococcus neoformans* is a common cause of fungal infection in the cat. All of these cats have cryptococcosis, with involvement ranging from superficial skin granulomas to deeper infections involving the nasal and sinus areas and sometimes even the chest cavity. This predilection for airway involvement is common in the cat and should always be on a list of differential diagnosis for any granuloma-like lesion involving the nasal and oral areas.


57e


57f

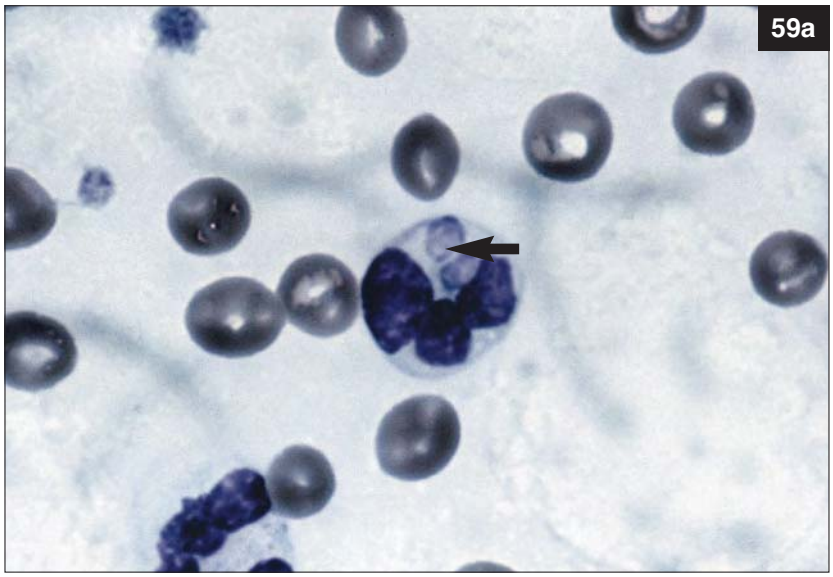

57g

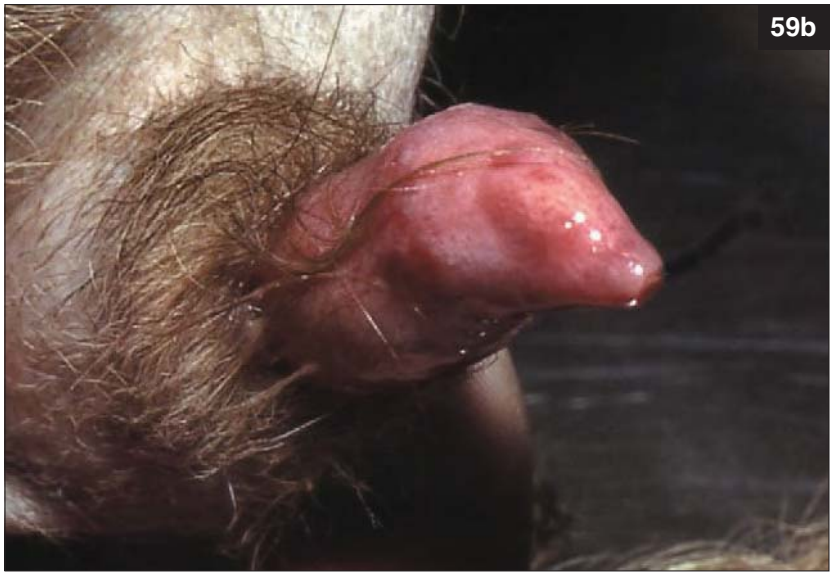




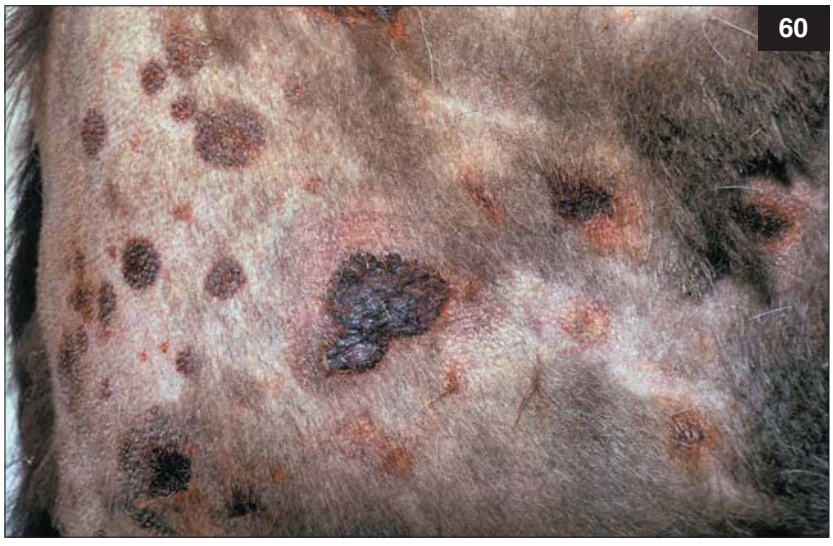
58a–c Cryptococcosis. This fungal granuloma (**58a**) was first thought to be a tumor, but cytology confirmed it to be *Cryptococcus neoformans* infection (**58b, c**). Various laboratory tissue stains can be used to visualize the organism, including Diff-Quick, New Methylene Blue, Gram, India ink (**58b**), and Giemsa and Wright (**58c**).

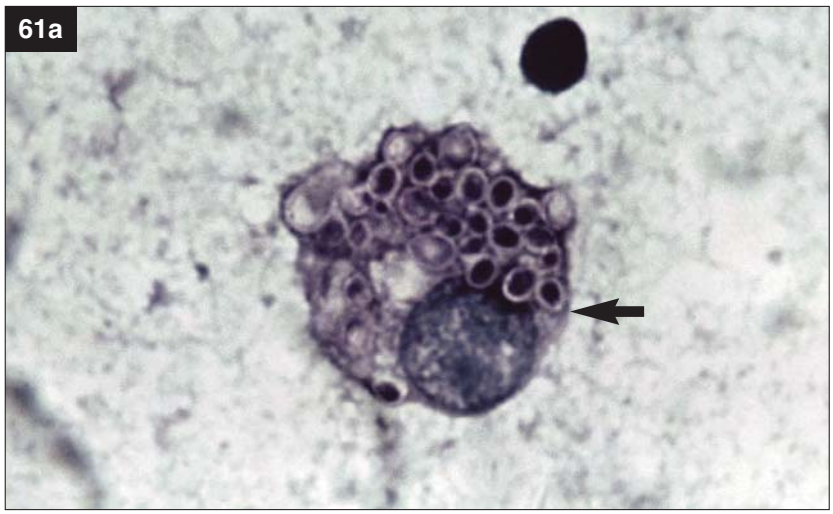
59a, b Ehrlichia canis. Shown is an ***Ehrlichia*** morula within a leukocyte (**59a** - arrow). The ***Ehrlichia*** infection in this young Chesapeake Bay Retriever caused pancytopenia, fever, depression, and joint pain. The only detected petechiation was on the dog's penis (**59b**). The infection responded very well to tetracycline, which was administered daily for one month. Doxycycline is presently the drug of choice and it is administered for up to 2–4 weeks' duration.

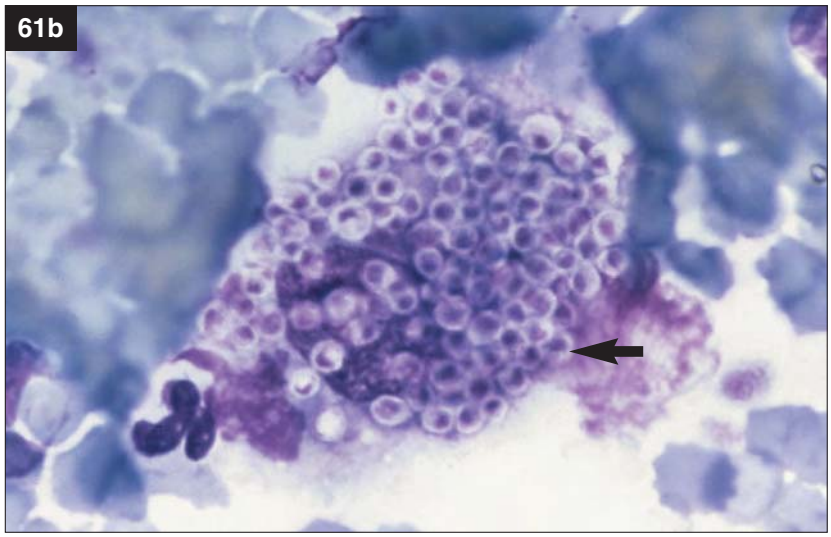




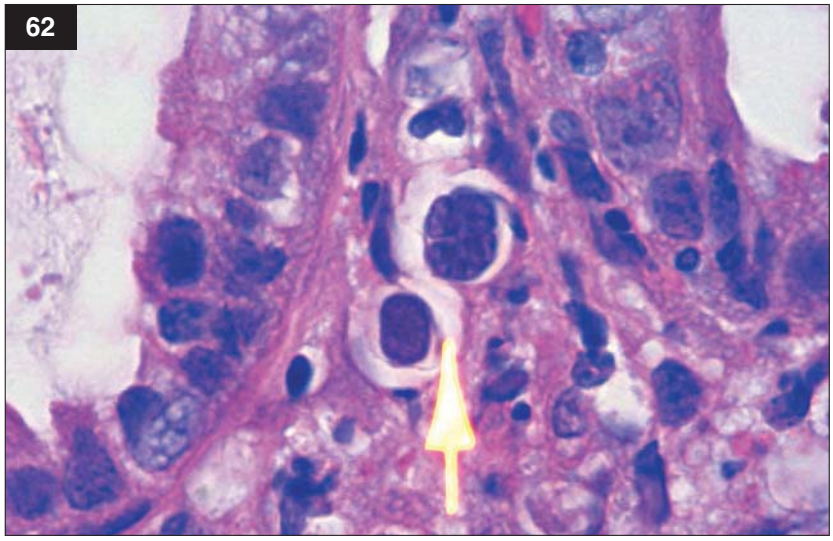
60 Cutaneous sign of sepsis. The dog that had these skin lesions had ***Pseudomonas*** species septicemia. The bacteremia caused a cutaneous vasculitis that resulted in these septic skin infarcts. The bacteria can sometimes be seen on cytology of the skin lesion. Same image also seen in case **12**.





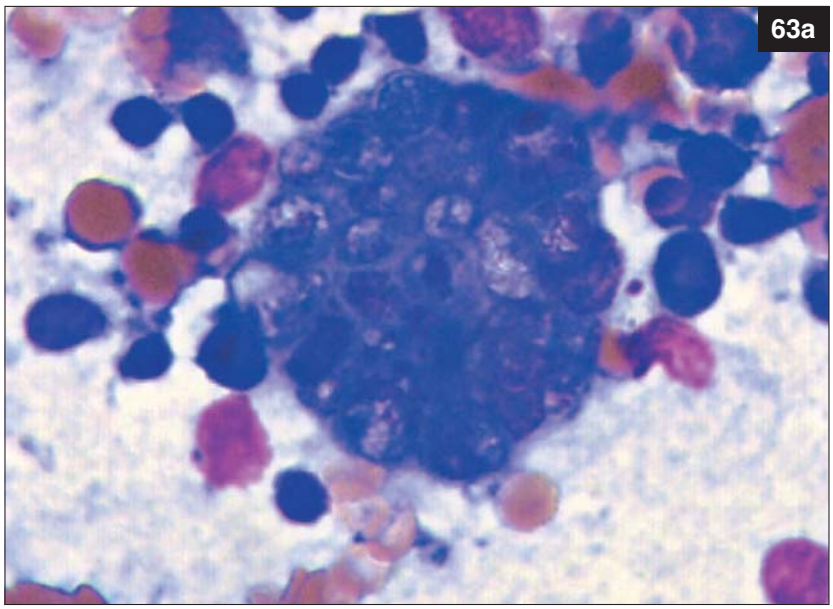


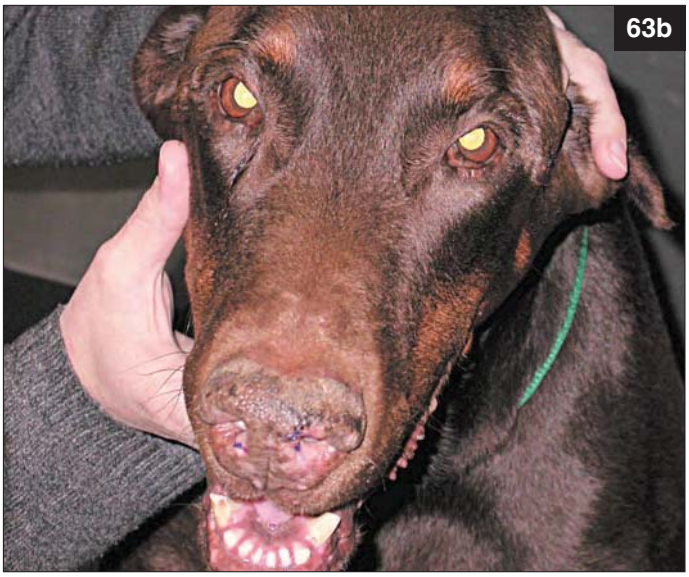
61a, b Histoplasmosis.
This *Histoplasma capsulatum*-laden macrophage was found on a fecal smear from a male Dachshund that had chronic diarrhea and weight loss. The dog probably acquired the infection by entering burrows in the infected ground during field trial competition in the State of Maryland in the United States. Shown are two separate slide preparations containing macrophages filled with the fungal organisms, each with its thin capsule.



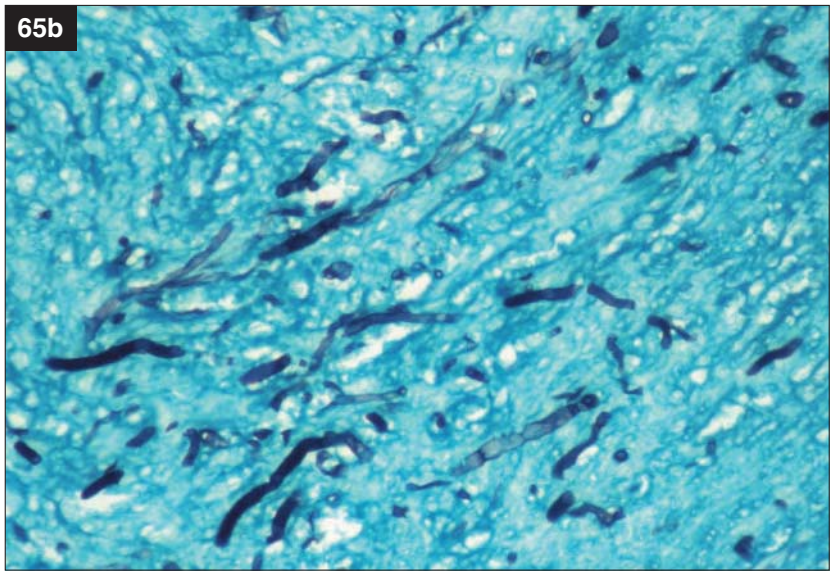
62 Protothecosis.
This photomicrograph shows *Prototheca zopfii* in the colon mucosa. The clinical signs in this dog included tenesmus and red bloody stools.

63a–d Protothecosis. *Prototheca* species is an algae that can affect the dog's bowel, central nervous system, retina, and skin. These images from a Doberman Pinscher show the organism, ***Prototheca wickerhamii***, within a macrophage (**63a**) and in several sites of skin involvement including the nose (**63b**), hock (**63c**), and scrotum (**63d**).





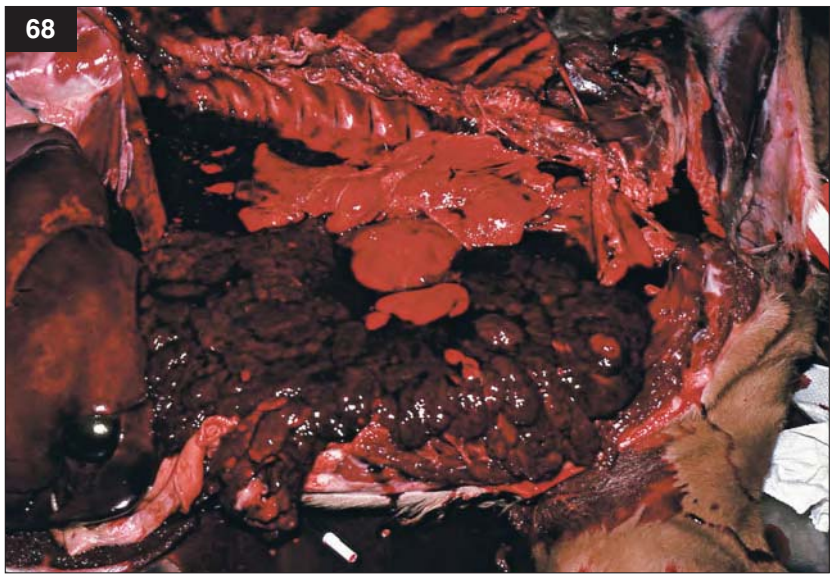
64 Pythiosis.
Hindlimb swelling in this dog was caused by ***Pythium insidiosa***, a water borne fungus-like disorder found commonly in the Southeastern United States as well as in other parts of the United States and the world. Besides cutaneous involvement, it commonly involves the digestive tract, very often with fatal consequences.



65a, b Pythiosis.
Shown is pythiosis gastritis, which caused pyloric outflow obstruction (**65a**). The dog's history indicated progressive vomiting of gastric contents over a period of one month. Such infections commonly stimulate a substantial fibrous tissue reaction. This dog's stomach involvement was deemed not treatable because of its advanced disease state. The organisms are shown in the photomicrograph, using special stain (**65b**).

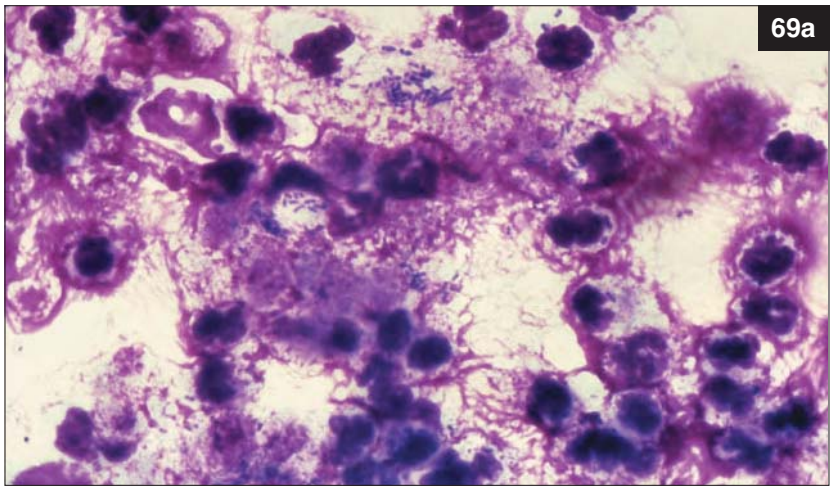
66a, b Pythiosis.
The *Pythium* species-induced granuloma (**66a**) in the caudal abdomen and hindlimb of this dog caused marked venous engorgement in the peripheral venous channels because of venous obstruction involving the deep veins (**66b**). Same image also seen in case **17**.

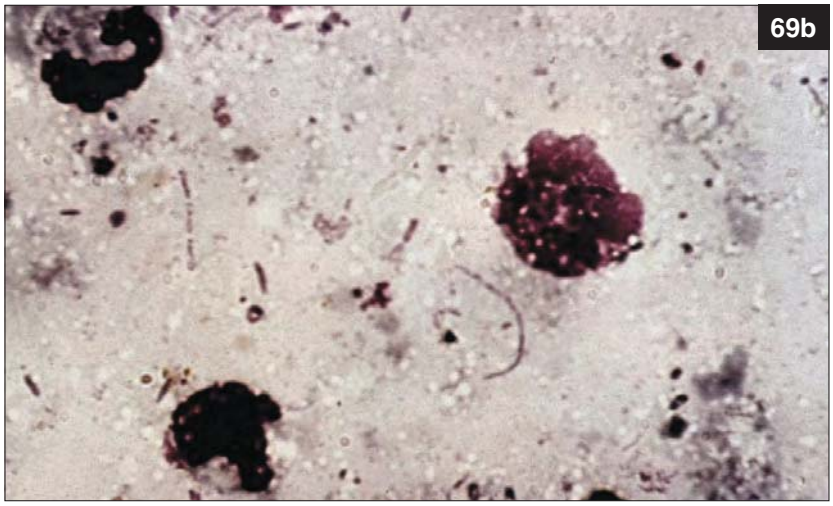
67a, b Pythiosis.
This granulomatous mass involving the ventral thoracic skin was caused by ***Pythium*** species infection (**67a**). Many dogs infected with this organism have commonly been exposed to stagnant water, which is the source of the infection. Treatment with antimycotic drugs rarely controls this disease. Aggressive surgical resection of the involved body part offers the best chance for cure. The location and large size of this lesion would have prevented complete removal of the infected tissue. The dog in (**67b**) has pythiosis involving its hard palate; this location would also limit attempts for complete surgical removal. Same image also seen in case **16**.



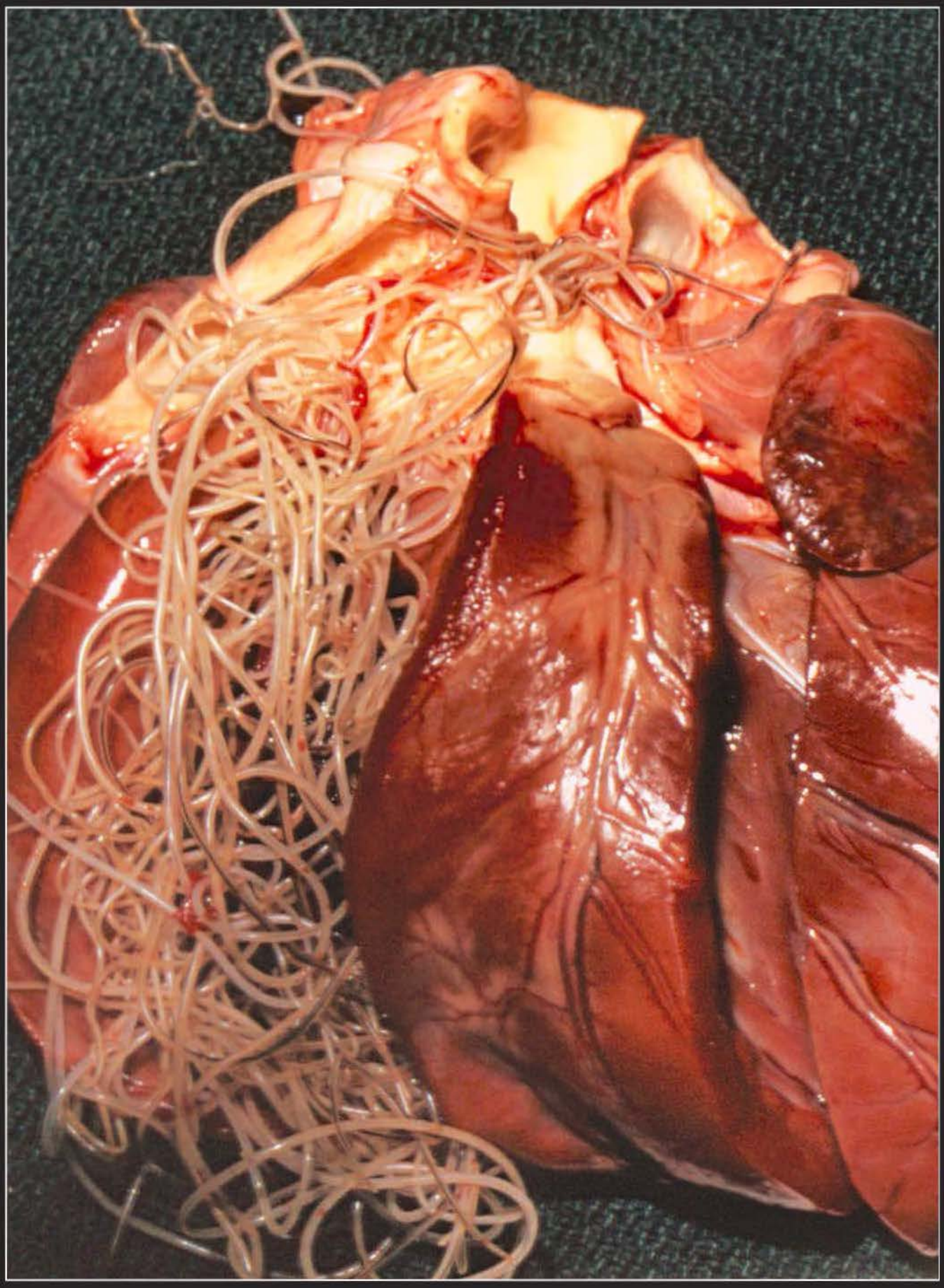
68 Suppurative pleuritis.
Actinomyces species and ***Nocardia*** species are two of several bacterial types that can cause suppurative pleuritis in the dog. This was a subacute to chronic ***Nocardia*** infection, where the liquid pus stage was replaced by a fibrous 'blanket' of suppuration that would not have been amenable to conservative treatment measures. A radical surgical decortication procedure would have been necessary in this dog.

69a, b Sepsis.
These microscopic views of abdominal fluid cytology taken from a critically ill dog show septic features as evidenced by the presence of 'toxic' neutrophils and the presence of bacteria both inside and outside the neutrophils. Exploratory surgery of the dog's abdomen would definitely be indicated with this kind of cytologic finding. (Images courtesy University of Florida Clinical Pathology Service)





70 Septic arthritis.
The hock shown is from a female dog that had been treated with long-term glucocorticoid drugs for its pemphigus vulgaris immune skin disorder. It was thought that the resulting immunosuppression predisposed her to this emergency orthopedic disorder. The diagnosis was confirmed with joint aspiration for cytology and culture (***Streptococcus*** species), and the dog responded well to treatment consisting of the appropriate antibiotic drug and aspiration of the pus. The aspiration is therapeutic because it removes the enzyme-containing neutrophils that would damage the joint cartilage.



4

Cardiovascular disorders

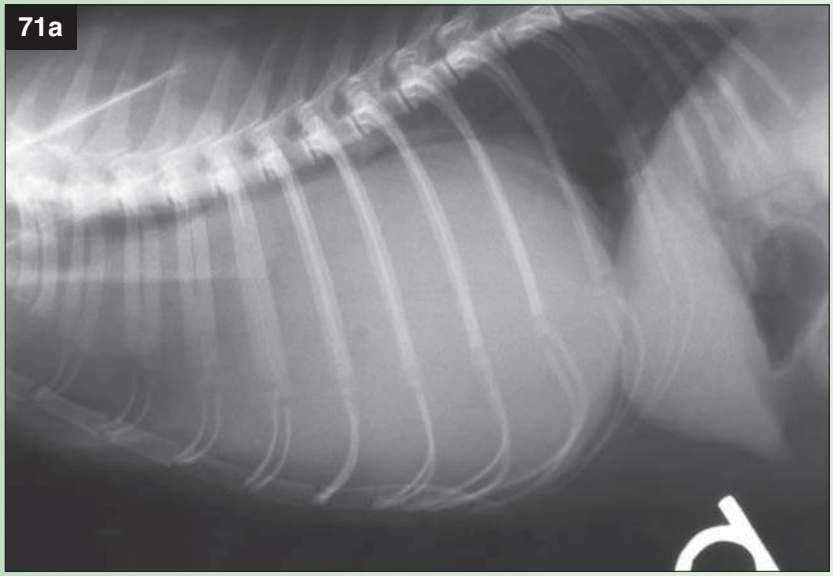
CARDIO comes from the Greek word ***kardia***, meaning heart. Cardiac disease presents with clinical signs that vary from the subtle to very dramatic. The physical signs can likewise vary, but when they reach a high degree of severity the patient can have severe respiratory distress from pulmonary edema, impaired circulating blood volume as can occur with pericardial effusion, abdominal distention from ascites, or perhaps acute arterial occlusion as occurs with a saddle thrombus. Most of the time the experienced clinician can identify the significance of these lesions, but the first encounter might be accompanied by some self-doubt. The potential lethal consequences of untreated heart disease demands early diagnosis, and most of these diseases can be diagnosed with a thorough history and physical examination, chest radiographs, and an electrocardiogram. With the discovery and application of echocardiography to clinical practice, the clinician can now appreciate the actual pathologic anatomy and abnormal function associated with cardiovascular disease.

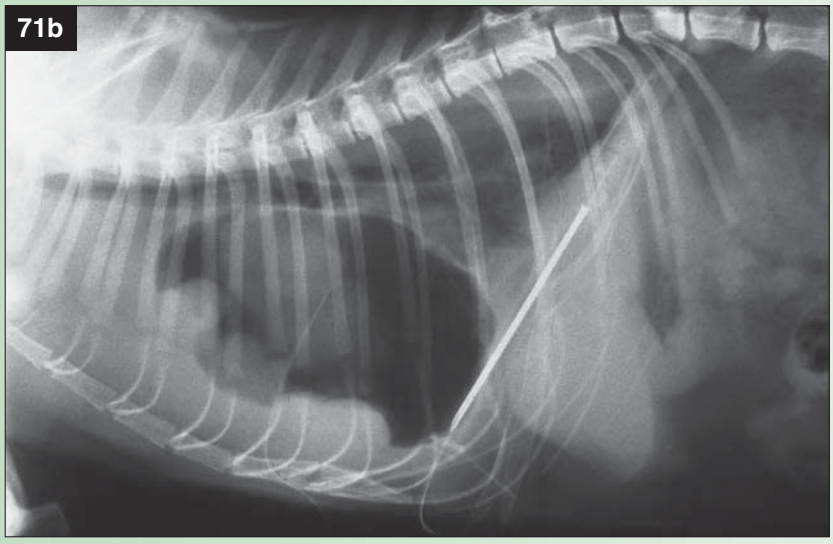
◀ Heartworm.

4

Cardiovascular disorders

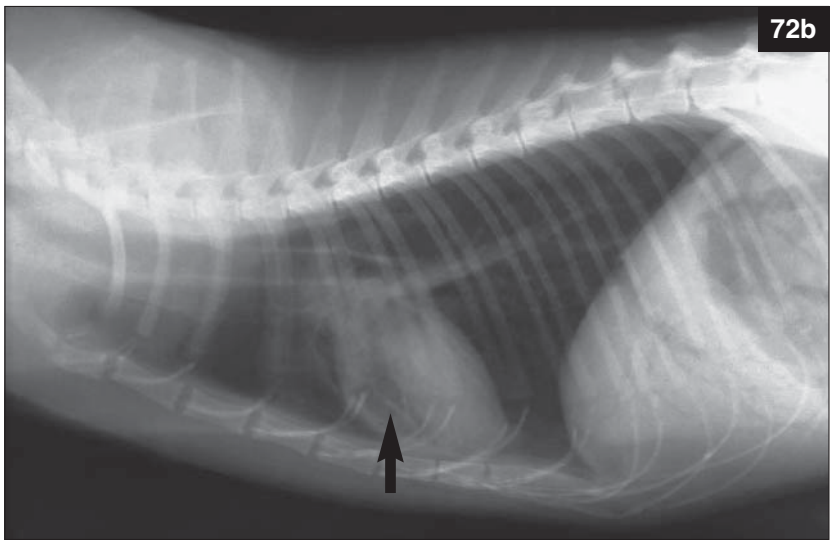
- Cardiomegaly does not always cause tall ECG complexes.
- A standing lead 2 ECG is satisfactory for rate, rhythm, and interval measurements.
- Cats with heart disease rarely cough.
- Heartworm treated dog at discharge: dispense prednisone and furosemide for the earliest signs of pulmonary thromboembolism.
- Echocardiogram for diagnosing vegetative endocarditis.
- Digoxin intoxication can cause any cardiac arrhythmia.
- Best not to use beta-blockers until pulmonary edema resolves.



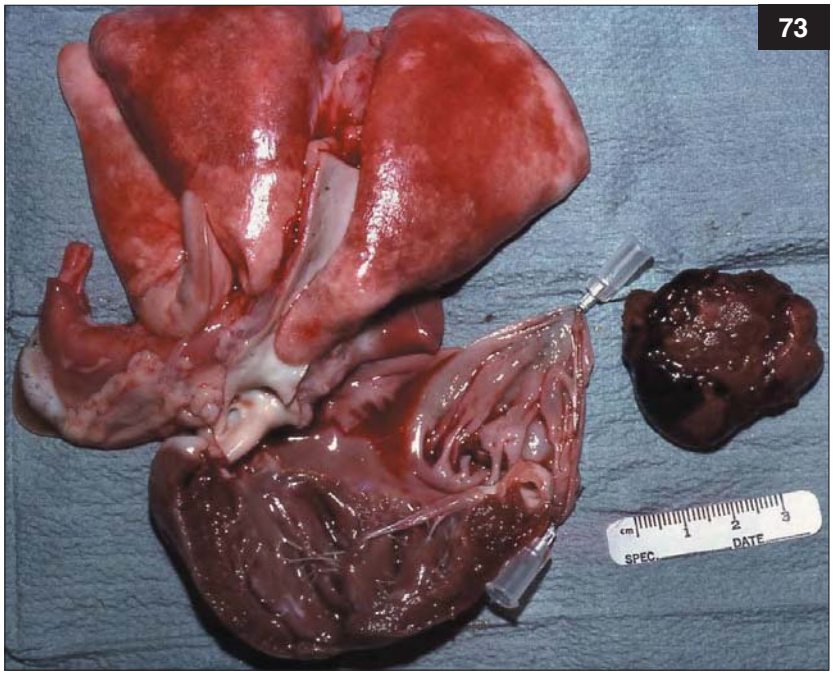


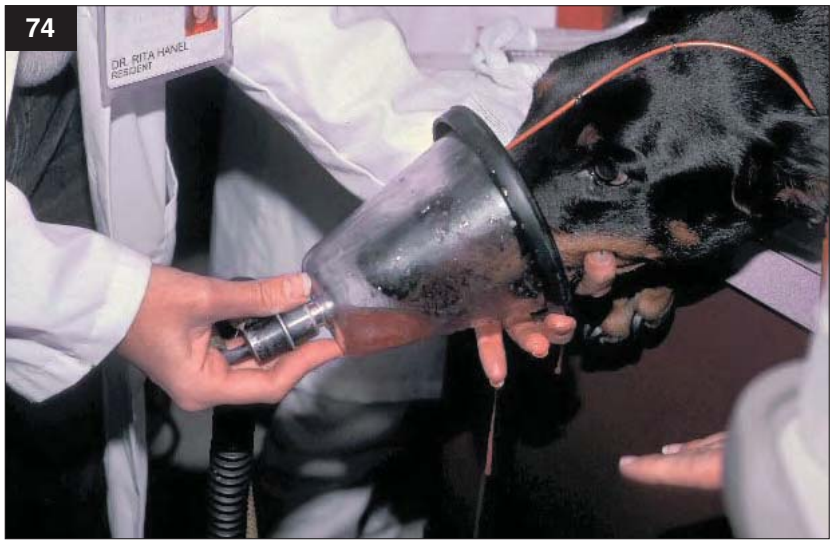
71a, b Pericardial mesothelioma. The radiograph on the left (**71a**) belonged to a 1-year-old dyspneic cat. It depicts the classic globoid heart shape typifying pericardial effusion. The other image (**71b**) is a pneumopericardiogram. It shows a soft tissue mass on the floor of the pericardial sac. Histopathology confirmed the mass as a mesothelioma.

72a, b Air embolus.
These radiographs were taken from a cat that died acutely after air was injected into the bladder during a pneumocystogram procedure. The injected air entered the posterior vena cava through a transitional cell carcinoma in the urinary bladder and then circulated to the heart, where it caused air entrapment within the right ventricle (arrow).

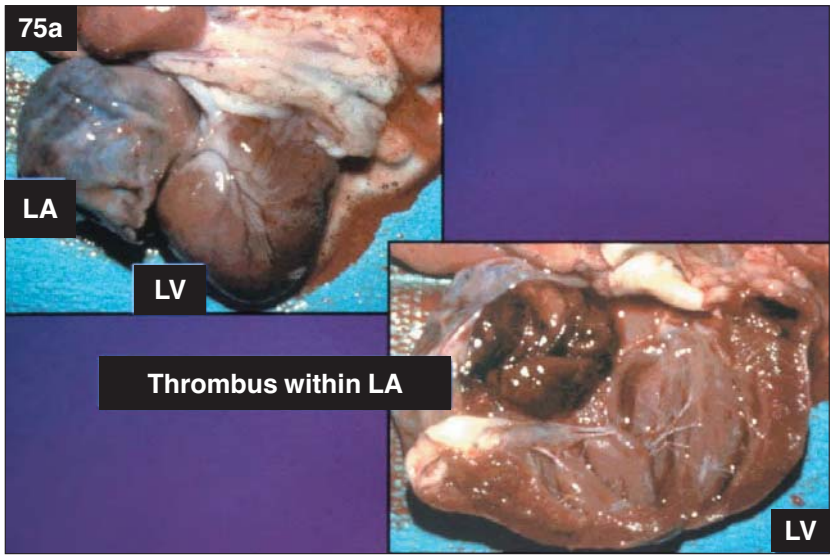


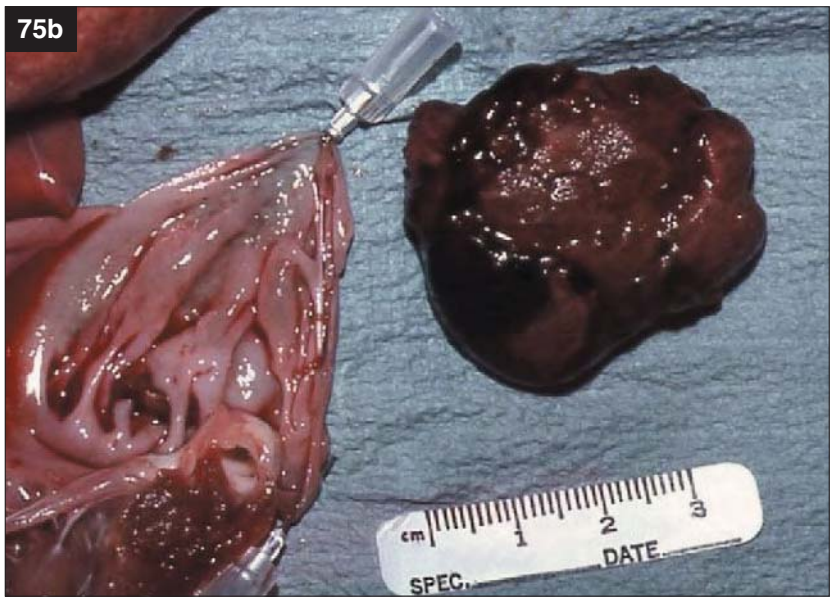
73 Atrial ball thrombus.
This postmortem image from a middle-aged cat shows a large left atrial ball thrombus that impaired left cardiac chamber filling and caused the cat's demise. Its cardiac output was severely diminished, thereby impairing blood flow to the brain, which is why the cat presented comatose.





74 Dilated cardiomyopathy. This Doberman Pinscher has fulminating congestive heart failure due to dilated cardiomyopathy. The severe pulmonary edema was actually flowing from the dog's mouth, as shown by the accumulated edema fluid in the oxygen face mask. This dog remained critical for the first 36 hours of hospitalization.

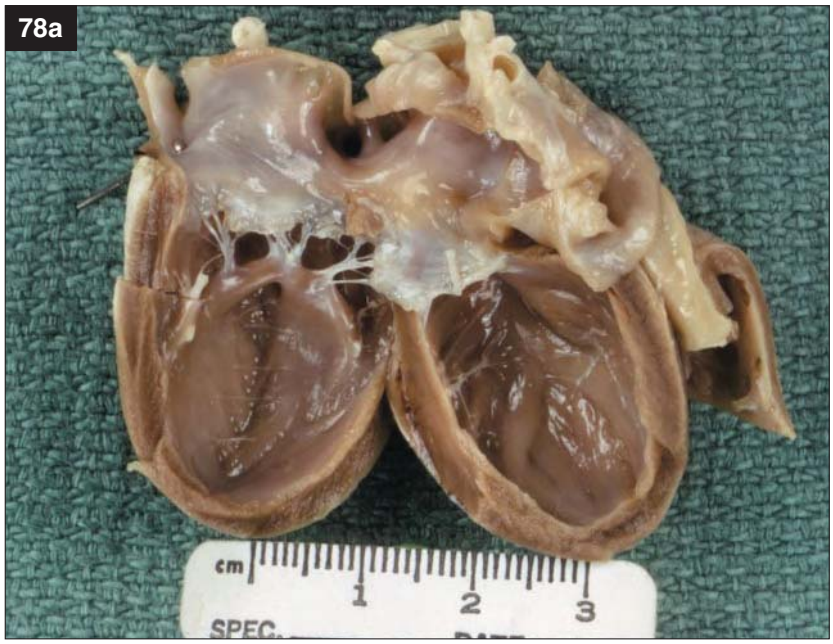


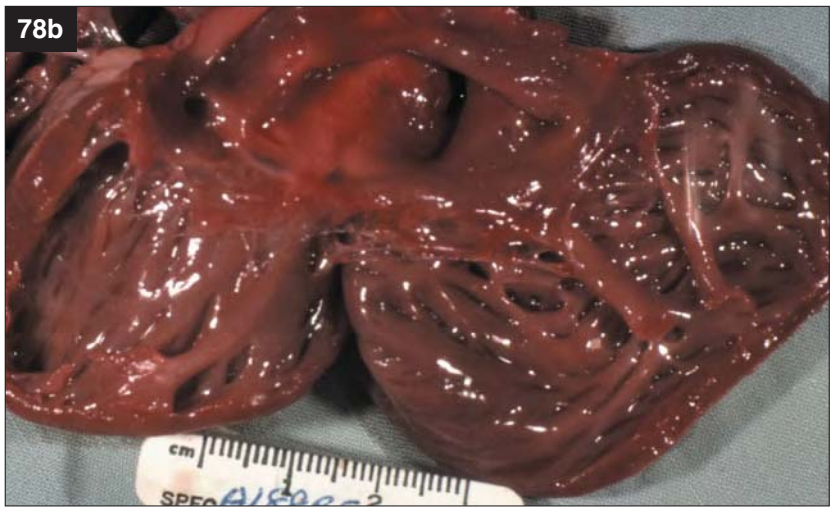


75a, b Feline cardiomyopathy. The saddle thrombus that occurs with cardiomyopathy is usually formed in the left atrium. The extremely large ball thrombus, such as the one shown here, would impair blood flow from the pulmonary veins and subsequently greatly diminish the cardiac output. These images show a very large ball thrombus in the left atrium before (**75a**) and after (**75b**) dissection. (Labeling in **75a** courtesy Dr P Snyder)

76 Feline cardiomyopathy. Open mouthed breathing is a sign of dyspnea, but its absence does not negate the severity of the problem. This cat had congestive heart failure. Other signs of respiratory distress included rapid and shallow breathing and a prominent abdominal component to respiration.

77a, b Feline hypertrophic cardiomyopathy. This is the most common form of acquired heart disease in the cat. The characteristic tachycardia, thickened muscular walls, and increased end-diastolic pressure contribute to an inadequate cardiac output. A mural thrombus sometimes forms in the left atrium. Congestive heart failure with this type of cardiomyopathy often causes pulmonary edema.

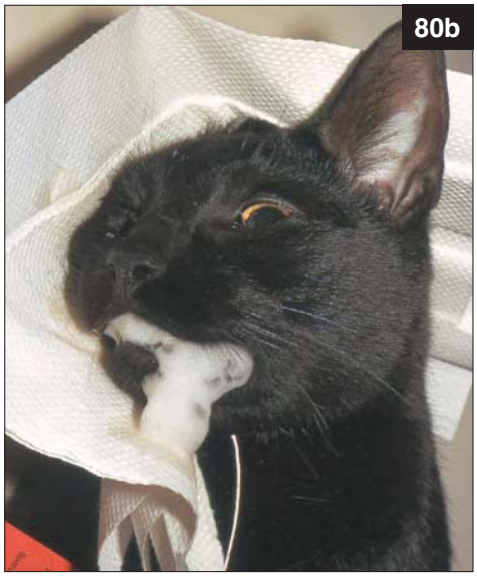




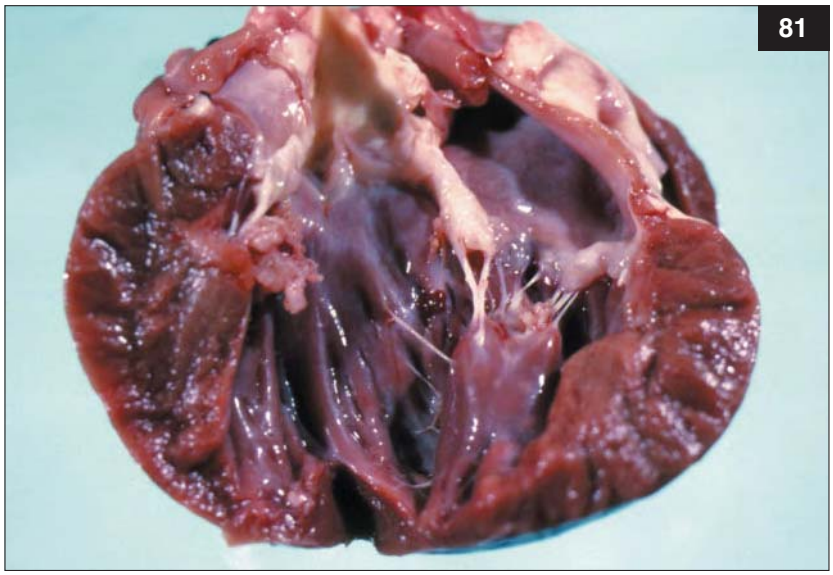
78a, b Feline dilated cardiomyopathy.
Cats with dilated cardiomyopathy have severely impaired cardiac muscle contractions. Taurine deficiency has been implicated as a cause in some cases. Note the characteristic saccular, dilated, cardiac chambers. Pleural effusion is commonly seen with this type of feline heart disease.

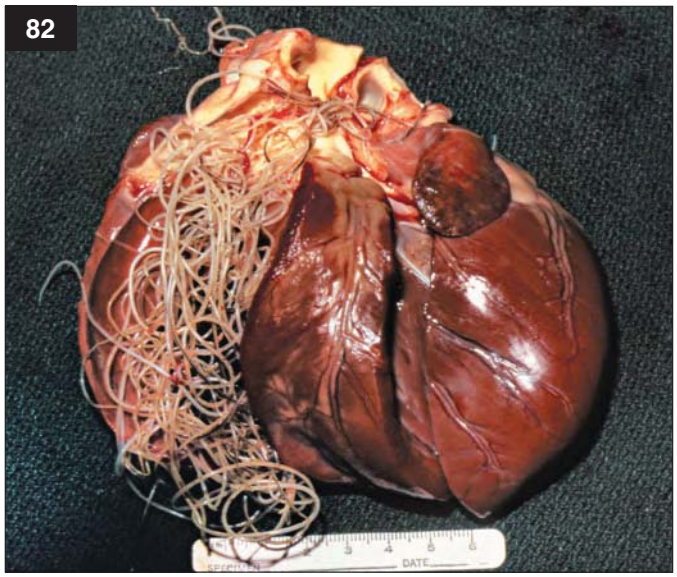
79 Feline cardiomyopathy-associated saddle thromboembolus.
This cat had a unilateral right hindlimb weakness caused by a thromboembolus to its right femoral artery. This was caused by its underlying cardiomyopathy condition. The involved limb was cool to the touch, pale, had absent femoral pulse, and had a firm gastrocnemius muscle.

80a, b Feline cardiomyopathy.
This syndrome should always be given a guarded to grave prognosis. This cat (**80a**) had an aortic saddle thrombus and was in the agonal stage of congestive heart failure. He died shortly after this image (**80b**) was recorded. His primary lesion was the hypertrophic form of cardiomyopathy. The cat might have been able to live longer if the heart disease had been diagnosed before this advanced stage set in. However, some of these severely affected cats might respond to treatment.



81 Marantic endocarditis.
Vegetative endocarditis does not always have an infectious cause. Marantic endocarditis is a term used in human medicine to describe a sterile form and it can be associated with neoplastic disease. The vegetative endocarditis that ensues can show the same clinical signs as that caused by infection.





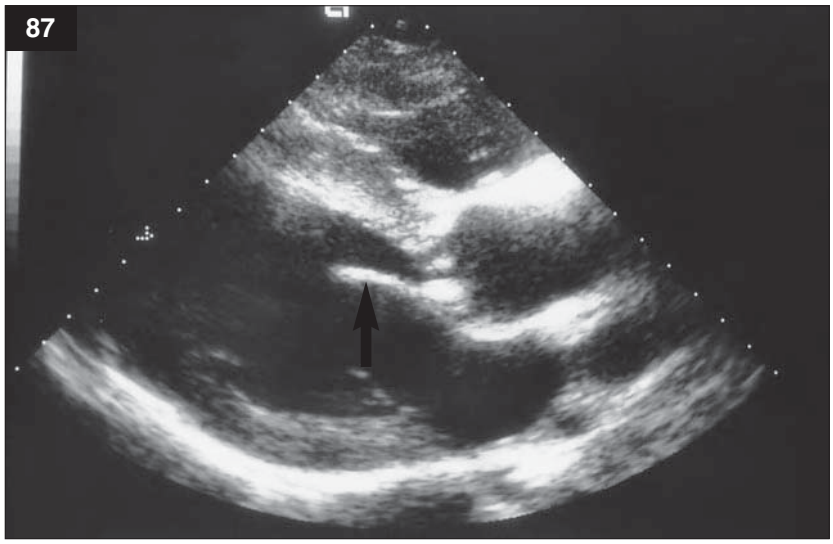
82 Heartworms.
Heartworm disease is still a worldwide problem. This postmortem heart specimen contained nearly 100 adult *Dirofilaria immitus*. The problems that can be associated with this worm burden include right-sided congestive heart failure, cardiac dysrhythmia, hypersensitive pneumonitis, and pulmonary artery thrombus formation and accompanying lung infarction.

83a, b Heartworm thromboemboli.
This coughing dog (**83a**) had hemoptysis and dyspnea occurring one week after heartworm adulticide treatment. The second image (**83b**) shows the same dog deceased after it exsanguinated in the middle of the night due to a rupture of a pulmonary artery. Such morbid consequences are sometimes unavoidable despite timely treatment intervention.

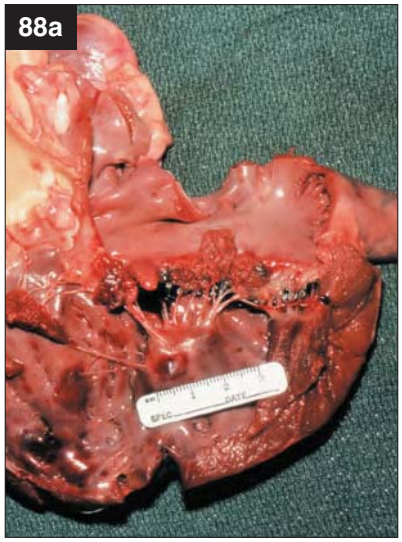
84a, b Saddle thrombus.
Shown are two saddle thrombus specimens that caused ischemic myopathy to both hindlimbs and acute paraplegia in each patient. Characteristic physical features would be hindlimb weakness or paraplegia, cool and cyanotic skin, weak or absent femoral pulse, and firm painful gastrocnemius muscles.

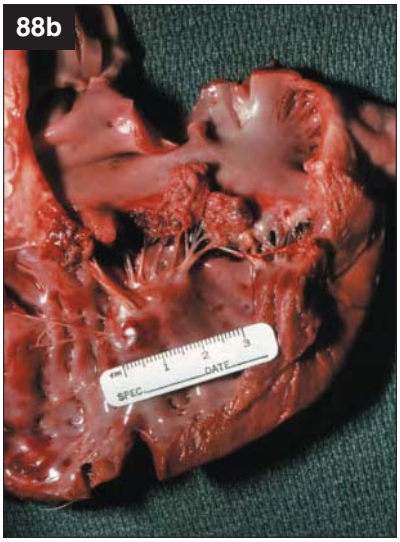
85 Saddle thrombus.
The ischemic hindlimb (arrow) of this cat is compared with the normal perfused forelimb. This was caused by cardiomyopathy and an accompanying aortic saddle thromboembolus. The chances for reperfusion are improved if the arterial occlusion is distal to the circumflex iliac artery.

86 Thrombus infarct.
Shown is a typical wedge-shaped vascular infarct involving a dog's ear. It was most likely due to the prothrombotic tendency accompanying this dog's underlying hyperadrenocorticism.

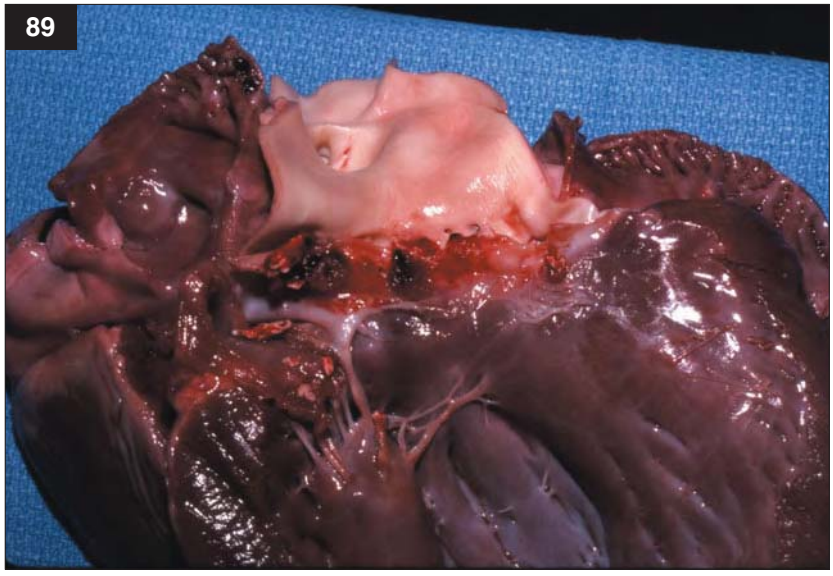


87 Vegetative bacterial endocarditis.
The use of echocardiography has improved our ability to diagnose bacterial endocarditis, as shown in this depiction of a thrombus on the aortic valve (arrow). It is possible for a fragment of this thrombus to enter the circulation and cause an ischemic tissue infarction anywhere it lodges.



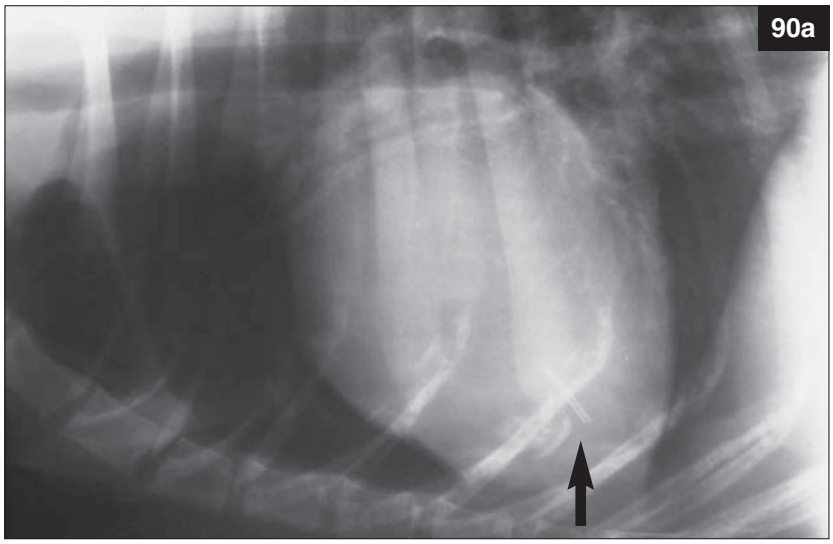


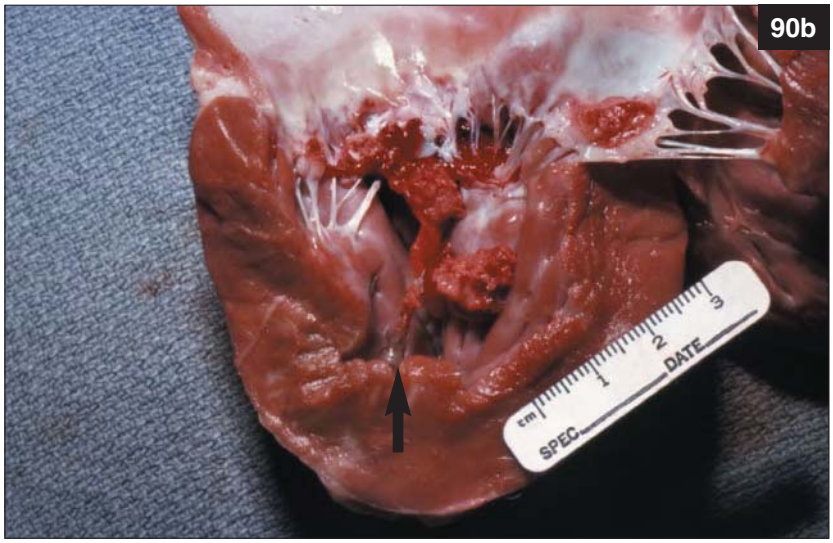
88a, b Vegetative bacterial endocarditis.
Shown are numerous vegetations on the mitral and aortic valves. If the patient survives treatment for the infection, the next main threats are thromboemboli and the peripheral end-organ effects that occur. Congestive heart failure from the grossly defective heart valves can also occur at any time.



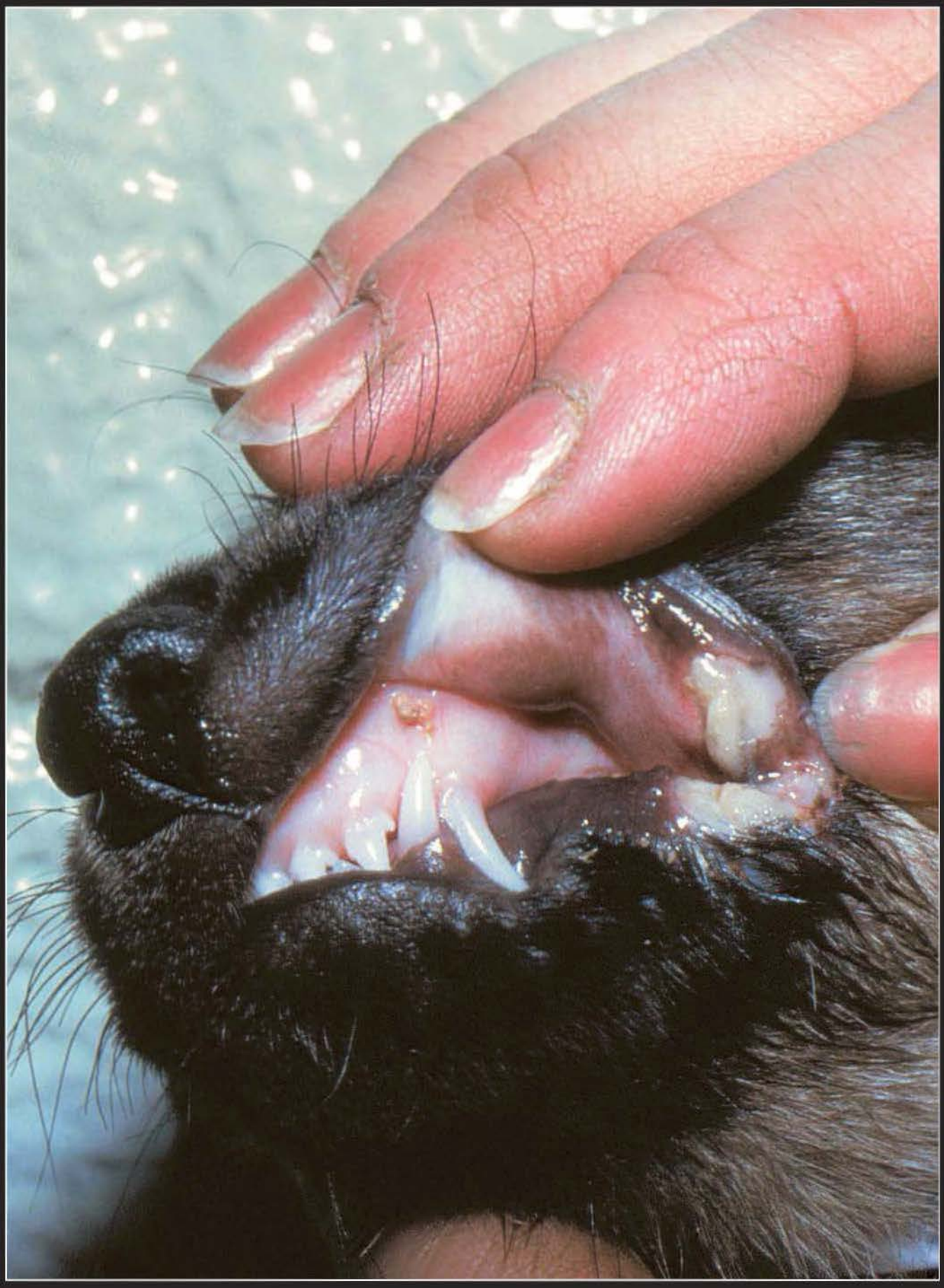
89 Vegetative endocarditis.
This heart illustrates the long-term destruction to the aortic valve 3 years after acute vegetative endocarditis. This led to the dog's demise from fulminating congestive heart failure. Only a valve replacement prior to the onset of heart failure would improve this dog's prognosis.

90a, b Vegetative endocarditis.
For some unknown reason, a needle had penetrated this dog's heart and caused vegetative endocarditis. Shown is the antemortem radiograph (**90a**) and the heart at postmortem (**90b**). It is possible that the needle was ingested, perforated the esophagus, then migrated and became lodged in the wall of the heart (arrows).





91 Acrocyanosis.
This dog suffered from heat stroke-induced peripheral hypoperfusion. The cyanotic digits reflect poor peripheral circulation, thus the term 'acrocyanosis'. This sign indicates a life threatening situation because of impaired circulation that might herald the onset of other conditions such as disseminated intravascular coagulation (DIC).



5

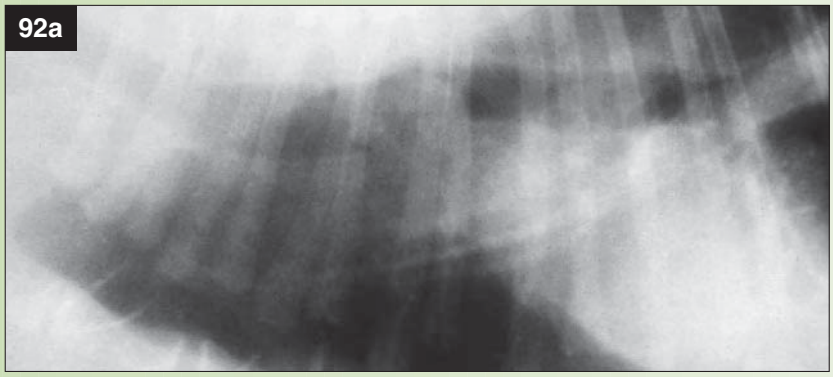
Respiratory disorders

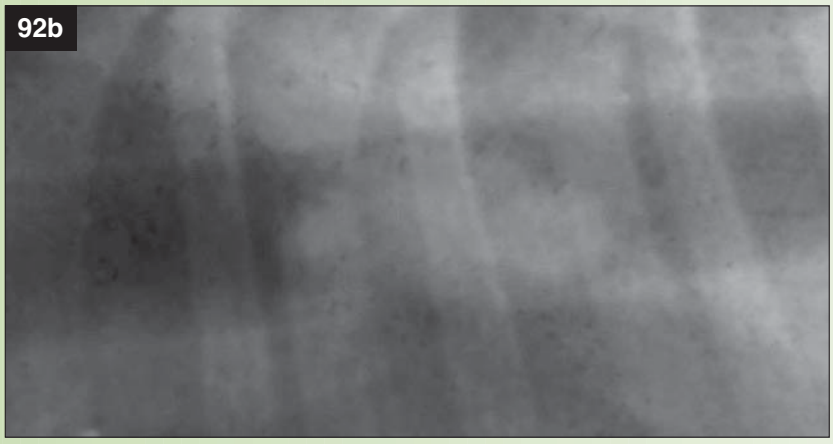
RESPIRATION is derived from the Latin word ***respirare***, meaning breathe again. The various clinical disorders of respiration can vary from those that are relatively minor to those that are life threatening. It behooves the clinician to have a sound understanding of the pathophysiology of these disorders, because life saving treatment might depend on it. Above all, the clinician should remember that the airway must be patent and that oxygen must be available at all times. It is also essential to remember that the two main functional disorders are defects in ventilation and defects in perfusion. The ability to recognize this in the patient will dictate the diagnostic and therapeutic plan. This is one group of diseases where a tissue diagnosis can be difficult to obtain, thus making it much more important for the clinician to use all available diagnostic information as accurately as possible.

◀ Electric cord burn in a puppy.

Respiratory disorders

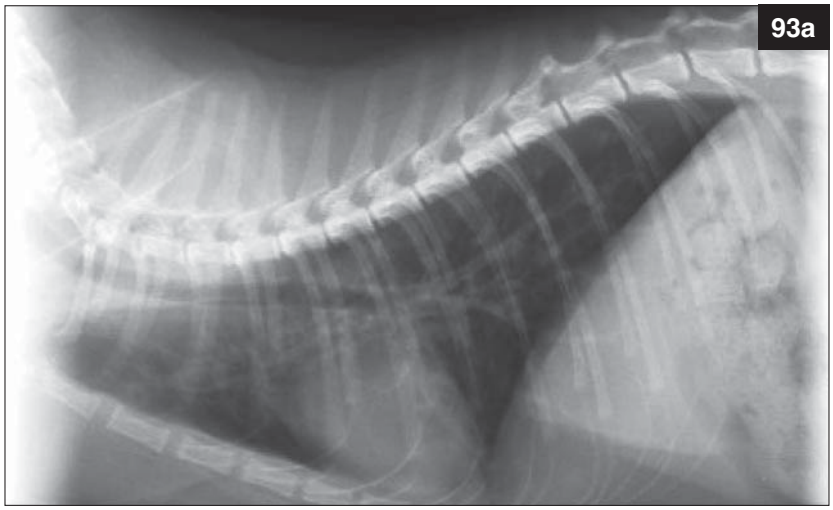
- Many die without ever showing open mouth breathing.
- Watch for the exaggerated abdominal component.
- Muffled chest sounds: fluid, mass, air, obesity, deep chested, 'plugged ears'.
- Diffuse muffling – usually chest fluid.
- Dorsal muffling – air or mass in chest.
- Coughing cats: allergic bronchitis, flukes, lungworms, heartworms, hair or foreign body in trachea, tumor.
- Sudden onset diffuse pulmonary infiltrates – think ARDS and neurogenic pulmonary edema.
- Bacterial pneumonia plus leukopenia (bone marrow associated) – causes minimal radiographic infiltrates.
- 3–5 mg (total) ketamine IV for a dyspneic cat can allow 'survival' radiographs.
- Remember – good side up when radiographing dyspneic patient.
- Aspiration pneumonia can be worse when H_2-blockers are used due to altered GI microflora.

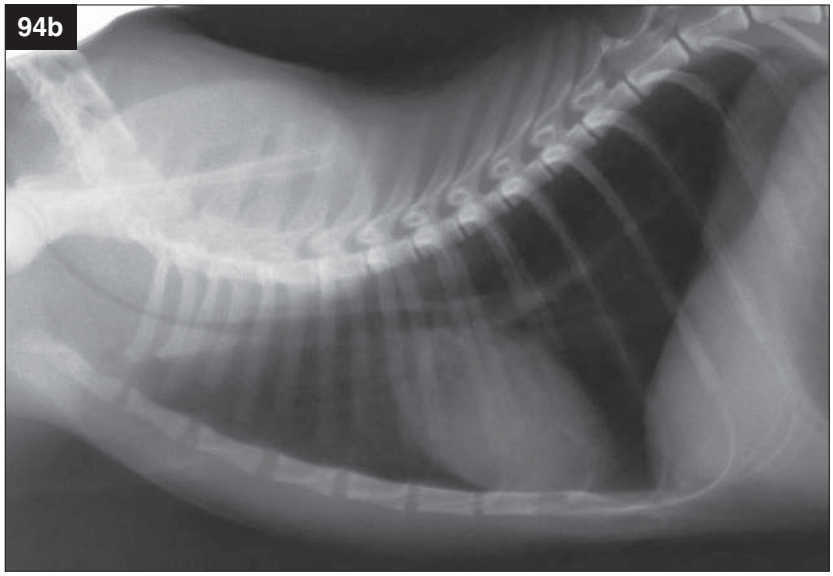


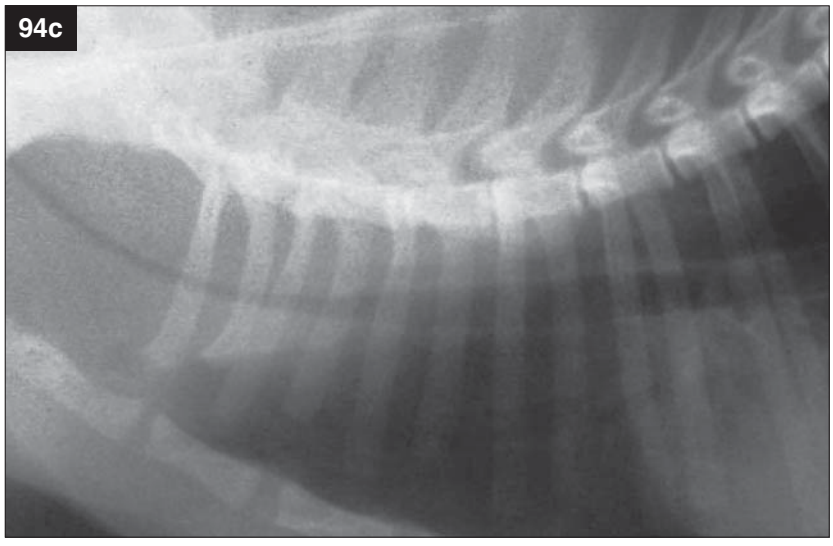


92a, b Tracheal tumor. These radiographs of a cat show a soft tissue mass within the trachea. A primary tracheal tumor would be in the differential diagnosis. The most common tracheal tumors in the cat are squamous cell carcinoma and lymphoma.

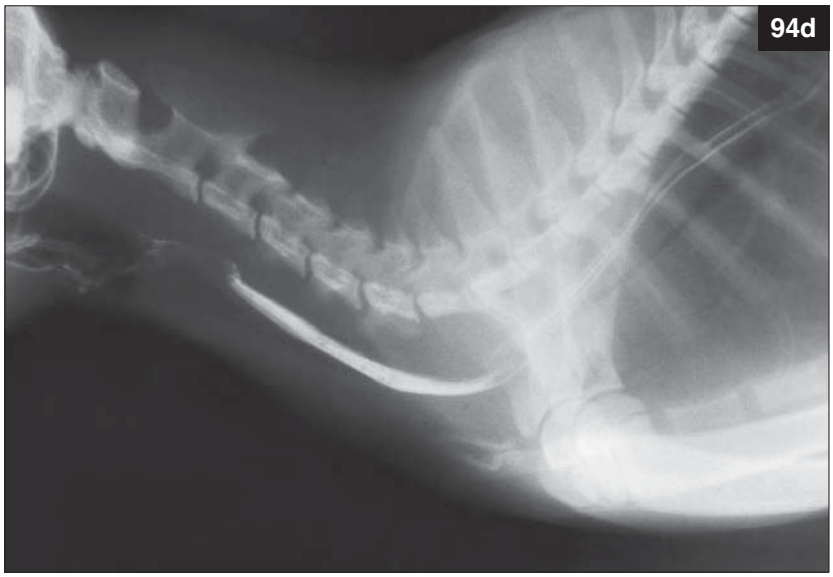
93a–c Allergic bronchitis. The radiographic features of feline allergic bronchitis include accentuated bronchioles with thickened walls and an air-filled center ('doughnut' effect). Hyperinflated lung lobes can also be present in a symptomatic patient.



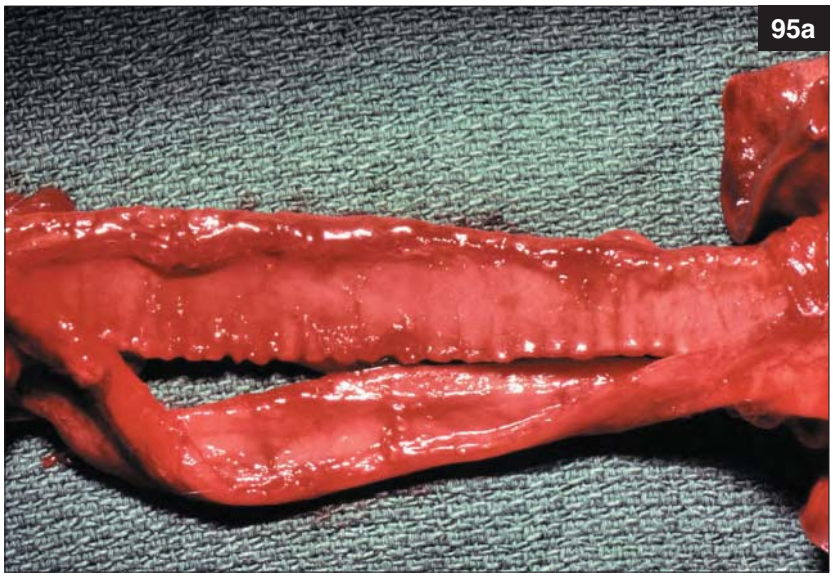


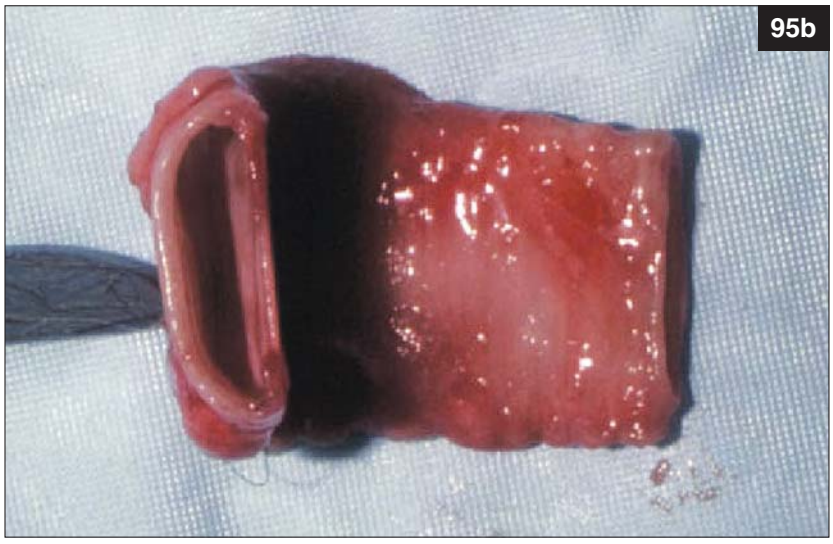


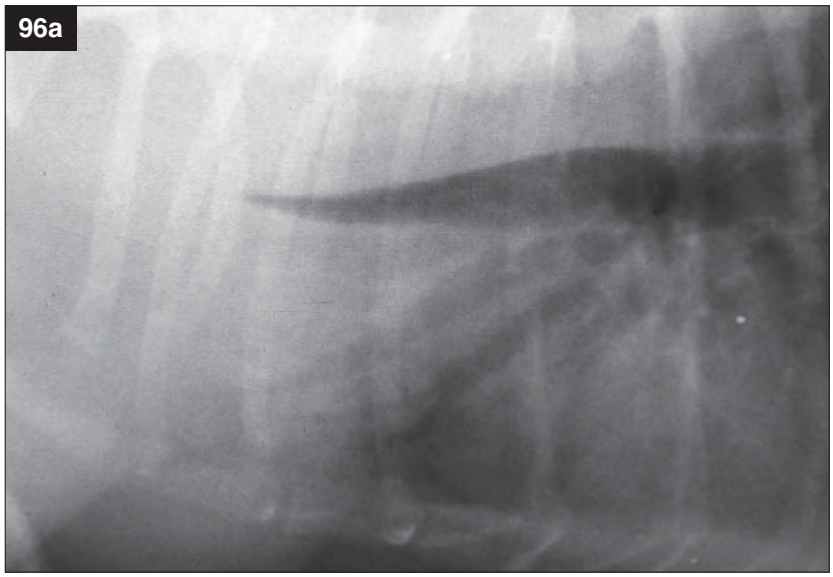
94a–d Collapsed trachea in a cat.
Both the plain radiographs (**94b, c**) and the lateral esophagram (**94d**) show a collapsed trachea in this young cat (**94a**). It was presumed to be congenital. The cat had respiratory stridor that was not responsive to medical treatment, leaving no choice other than to attempt surgical correction.

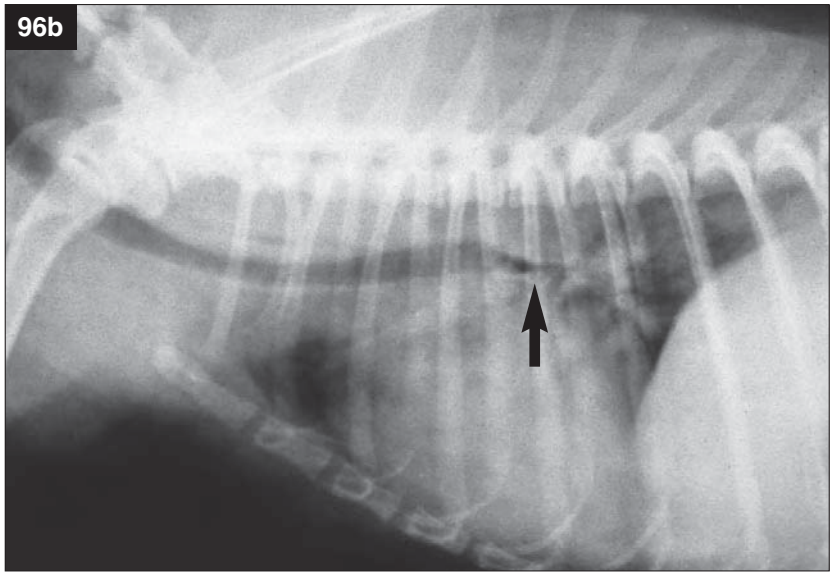


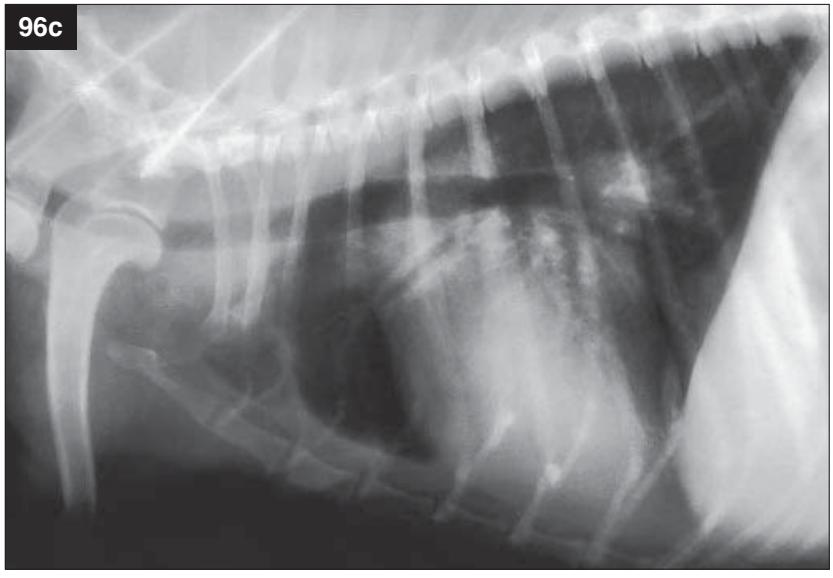
95a, b Collapsed trachea. This necropsy specimen is from a Miniature Poodle that showed signs of a severely collapsed trachea. Note that the trachea is as flat as the esophagus (**95a**). The dog's respiratory distress was not responsive to medical treatment. Note that the end-on view of the trachea is elliptical instead of round (**95b**), thus attesting to its severity. A normal trachea would be more round.



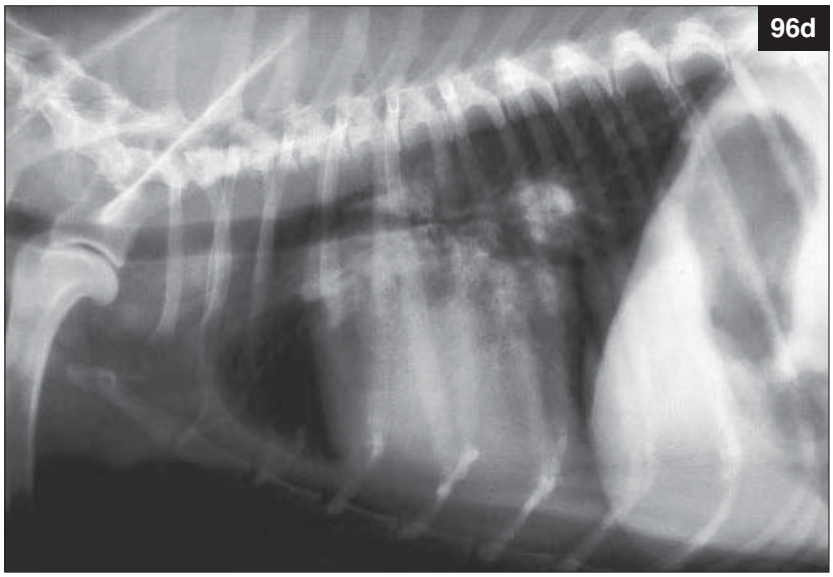




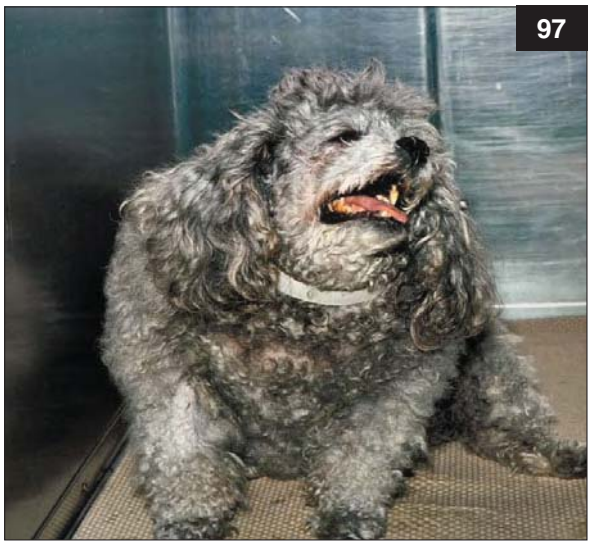




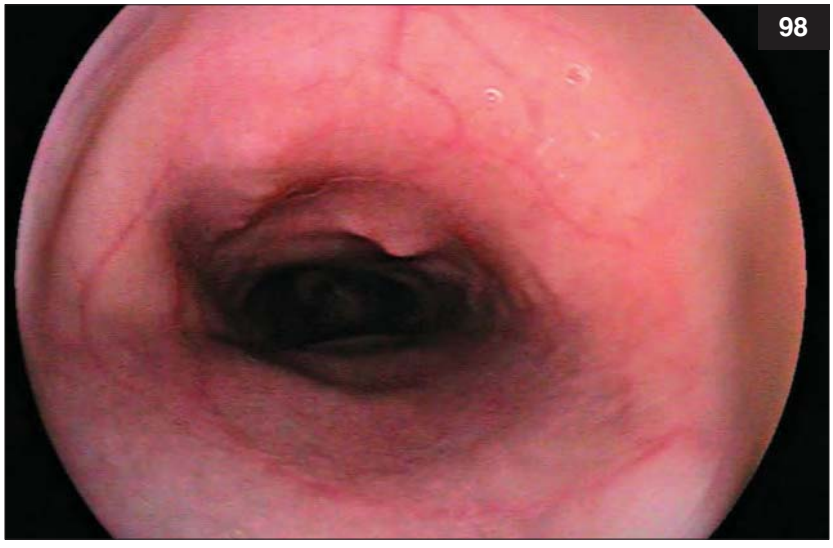
96a–d Collapsed trachea. Sometimes, a collapsed trachea is readily apparent with thoracic radiographs. Image **96** shows a narrow trachea and either collapse or infiltrate in the cranial lung lobe. Image **96b** shows collapse of the mainstem bronchus (arrow). Fluoroscopy can detect what might not be readily apparent on routine radiographs, especially when there is main stem bronchi involvement. This is illustrated in images **96c** and **96d**.

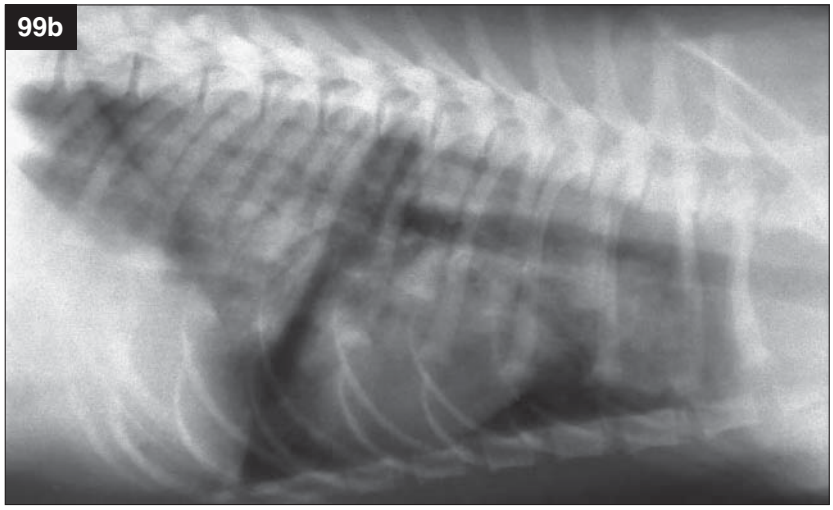


97 Collapsed trachea.
This condition can progress to a fatal end point, as shown in this Poodle just before her death. Supportive treatment included oxygen, aminophylline, prednisolone, and a low dose of furosemide. Sometimes, a mild tranquilizer helps to alleviate anxiety.



98 Collapsed trachea.
This is a bronchoscopic view of a tracheal collapse in a dog. The narrowing ahead of the scope is obvious. This narrowing might not be seen on a thoracic radiograph.



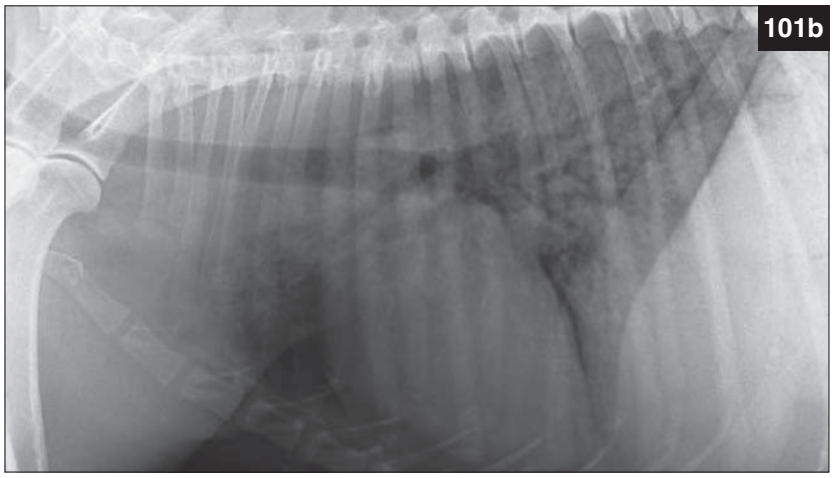


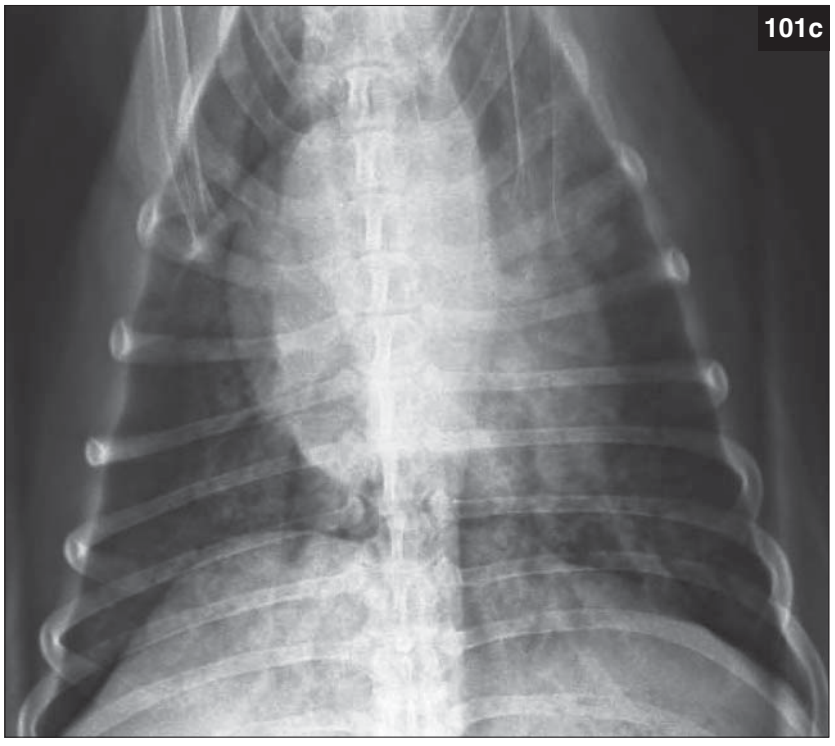
99a, b Neurogenic pulmonary edema.
This puppy bit into an electric cord and has an electric cord burn (arrow) on its mouth (**99a**) in addition to neurogenic (noncardiogenic) pulmonary edema. The lateral radiograph (**99b**) depicts an alveolar infiltrate with air bronchograms, which is typical of this disorder. This respiratory emergency requires oxygen treatment and, sometimes, diuretics for severe cases. The ulcer in the oral commissure is from the burn caused by the electric cord. This is a potentially fatal condition that should have a guarded prognosis for the first 24 hours.

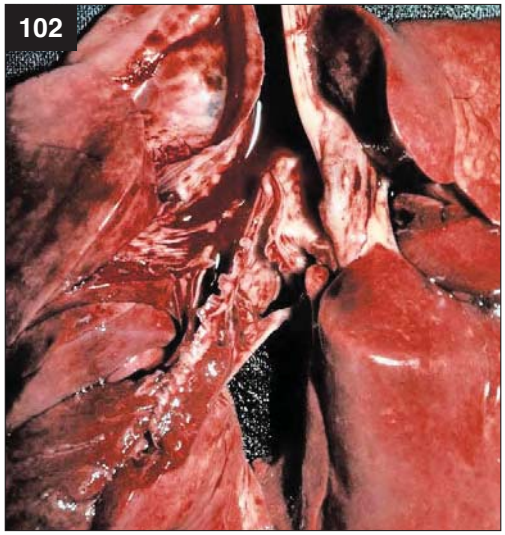
100 Neurogenic pulmonary edema.
This kitten experienced a similar situation to the puppy in case **99**. Shown is the burn on the right lower lip (arrow). Treatment consists of oxygen and diuretics, and in most cases the patient should improve after 24 hours.

101a–c Neurogenic pulmonary edema. Unbeknown to the owner, this hound (**101a**) had an underlying seizure disorder that caused an acute onset of noncardiogenic pulmonary edema, as shown in the accompanying radiographs (**101b, c**). The seizures were not actually observed until approximately 6 months later.

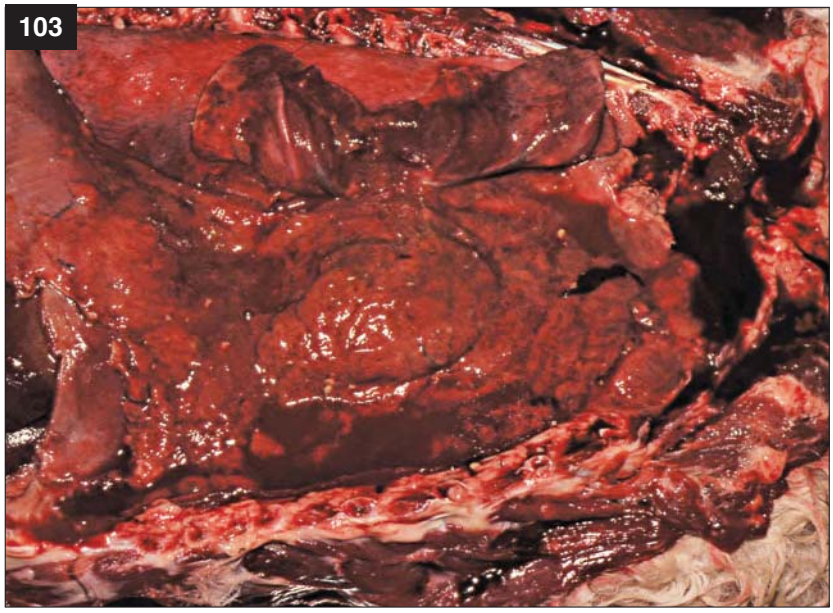

101a


101b


101c



102 Neurogenic pulmonary edema.
At postmortem examination, the lungs of dogs with neurogenic pulmonary edema actually contain more hemorrhage than edema. This is why diuretic treatment is not entirely effective for treating this problem.



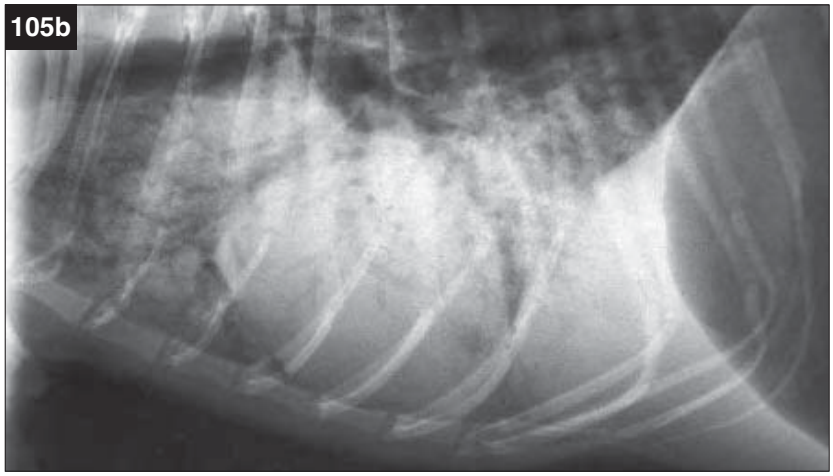
103 Pyothorax (suppurative pleuritis).
When liquefied pus is replaced by a fibrous mesh of suppuration, treatment will include surgical decortication of the involved thoracic viscera. As shown in this necropsy view, any thoracic surgical procedure would have been most challenging for all concerned. In the dog, *Actinomyces* species is commonly a cause of pyothorax, with *Nocardia* species being less common.

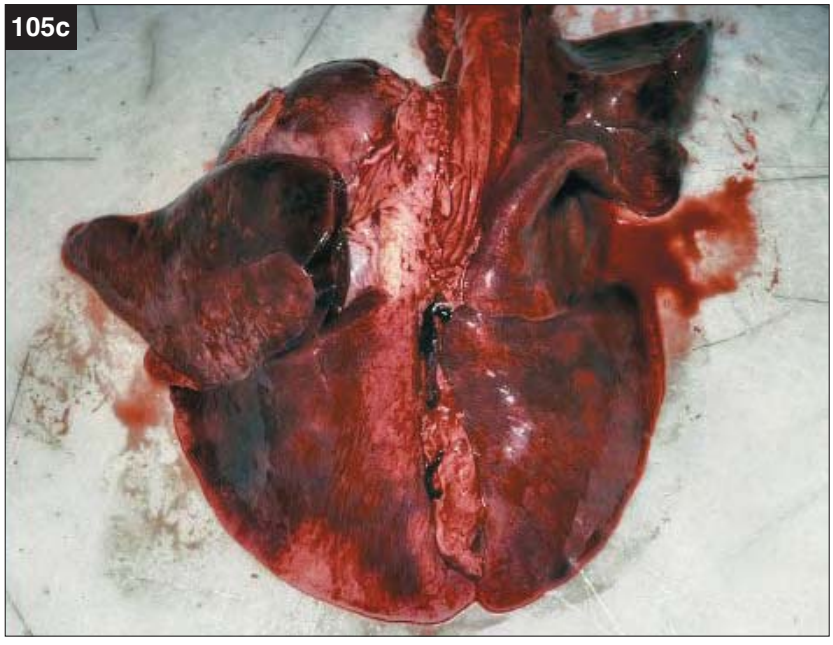
104a–d Dyspnea.
This Husky puppy (**104a**) is in respiratory failure from pulmonary hemorrhage caused by blunt thoracic trauma. A radiographic view is shown (**104b**). The puppy survived after he was anesthetized and placed on a ventilator for four days (**104c, d**) so that he could benefit from positive end-expiratory pressure (PEEP) ventilation.


104b


104c

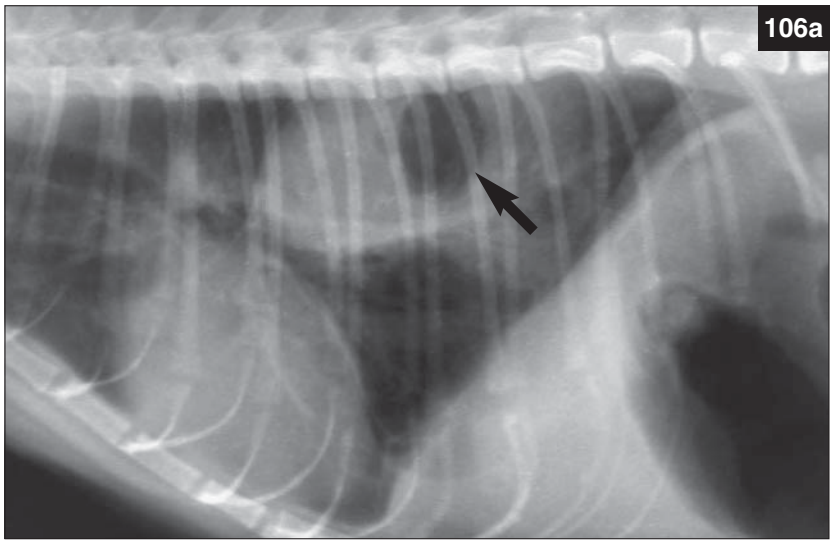

104d

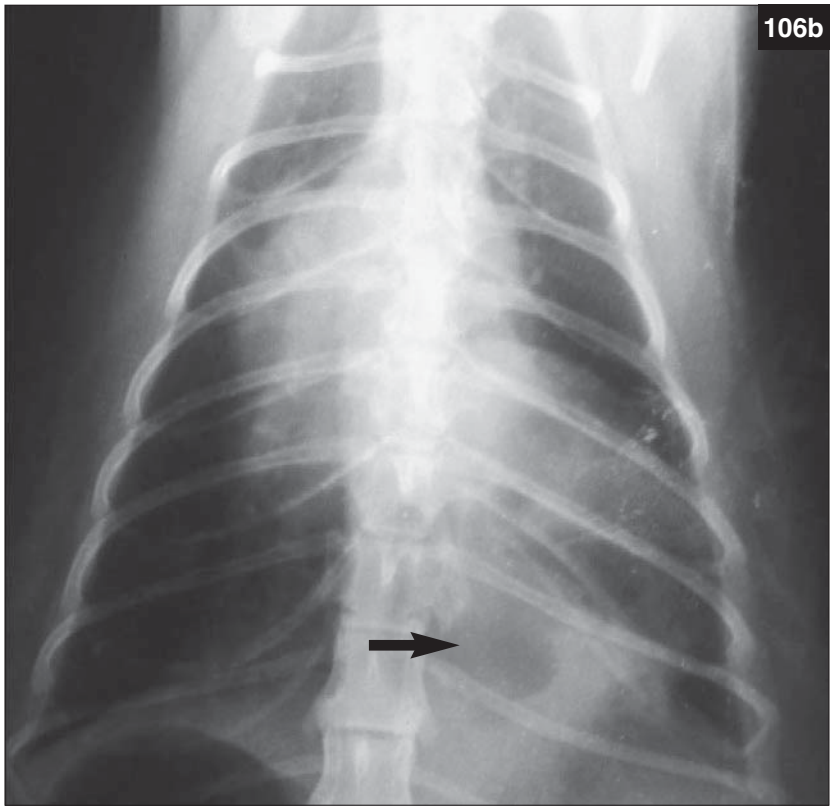




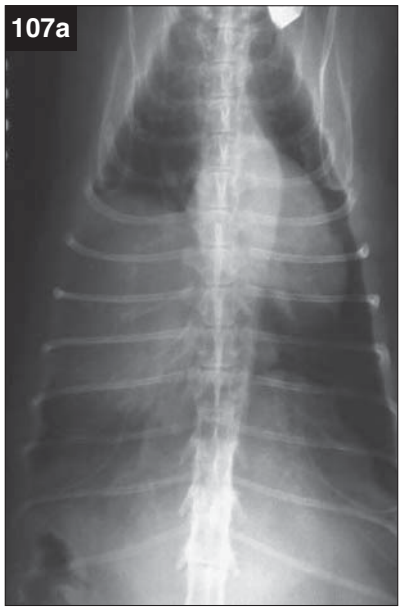
105a–c Lipoid pneumonia. Whilst at a boarding kennel, this Dachshund (**105a**) was given mineral oil orally because of its infrequent bowel movements. Aspiration of the oil caused severe granulomatous pneumonia (lipoid pneumonia), which proved to be fatal. The accompanying lateral radiograph (**105b**) shows an alveolar pattern with air bronchograms. The lungs at postmortem were severely and diffusely inflamed (**105c**).

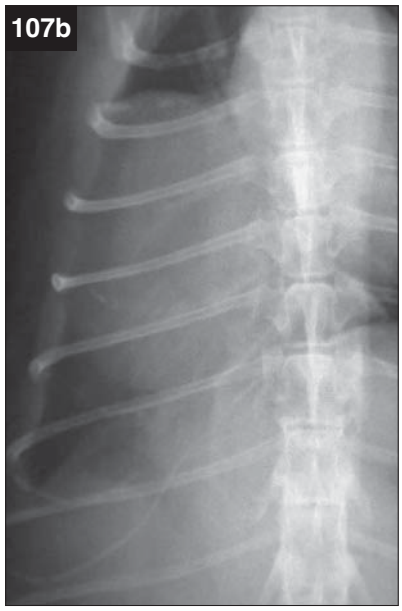
106a–c Lung abscess in a cat.
The lung lobe cavitation (arrows) seen on the radiographs (**106a, b**) is a lung abscess that was successfully surgically resected. The cat originally had a pyothorax approximately 3 months prior, which might have been due to this same pathologic lung lobe (**106c**).


106a

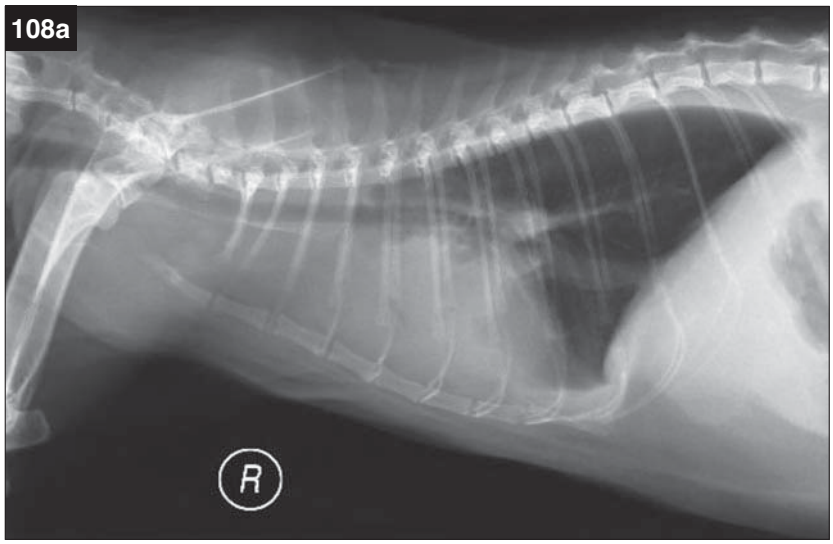

106b

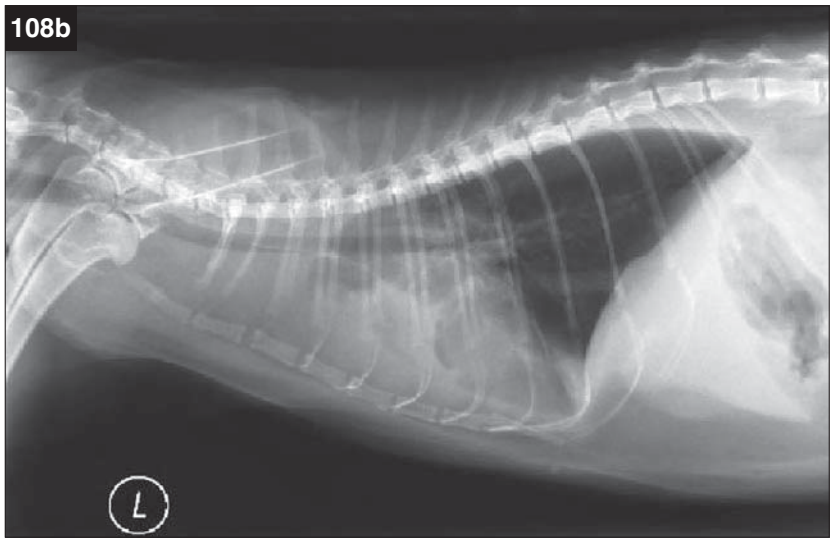

106c



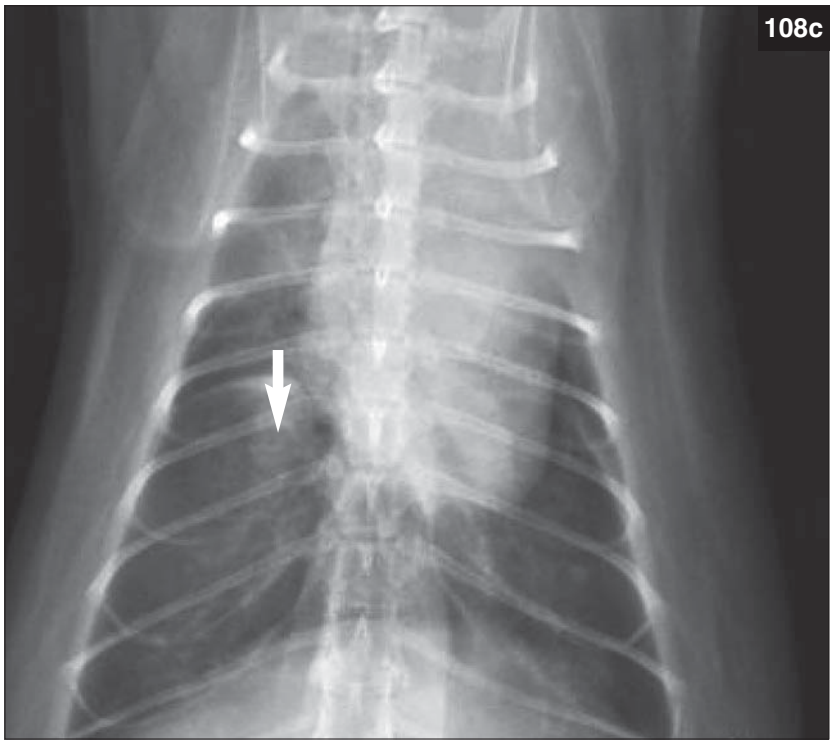


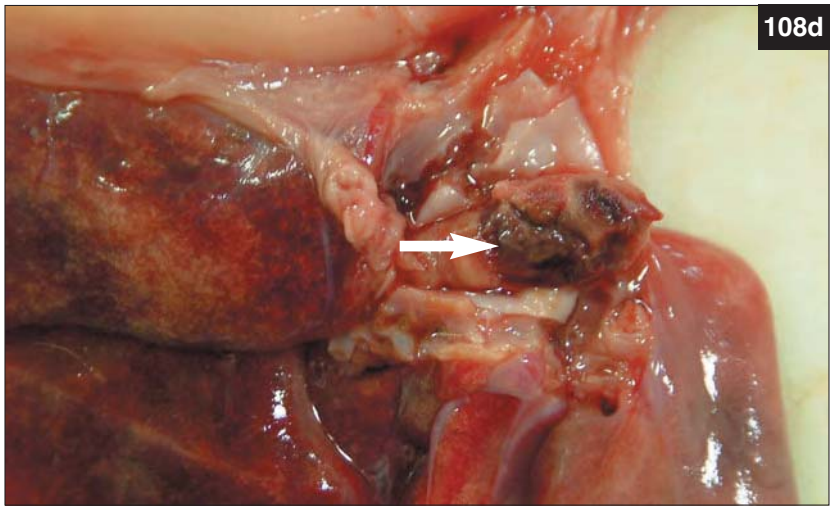
107a, b Diaphragmatic hernia.
The thoracic mass on these radiographs of a cat was caused by a small right-sided diaphragmatic hernia allowing the falciform fat to slip into the thoracic cavity. Note that the mass is of fatty density. Fine needle aspiration for cytology confirmed it as lipid. Surgery confirmed the small diaphragmatic hernia that had been undiagnosed prior to this particular visit.

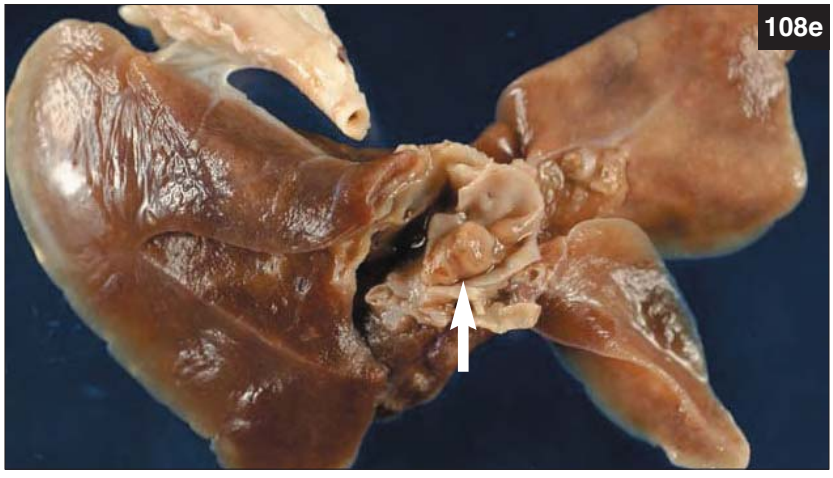


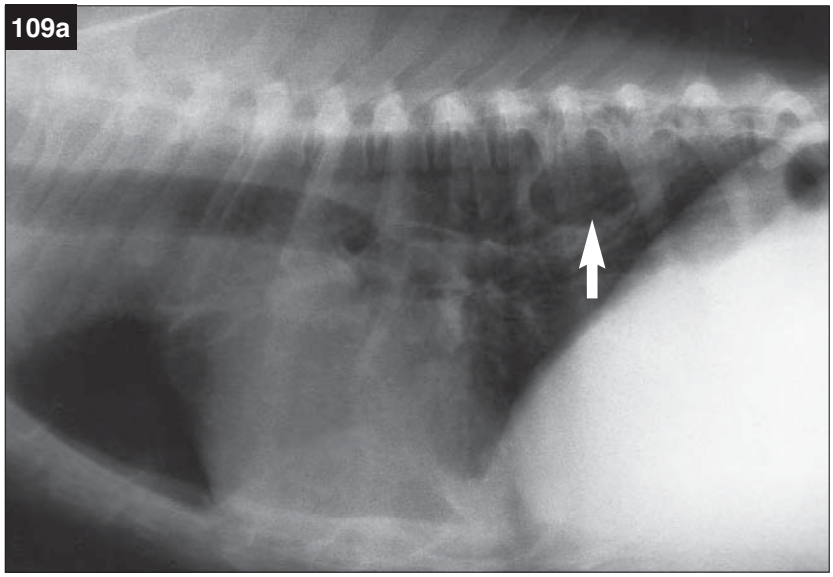


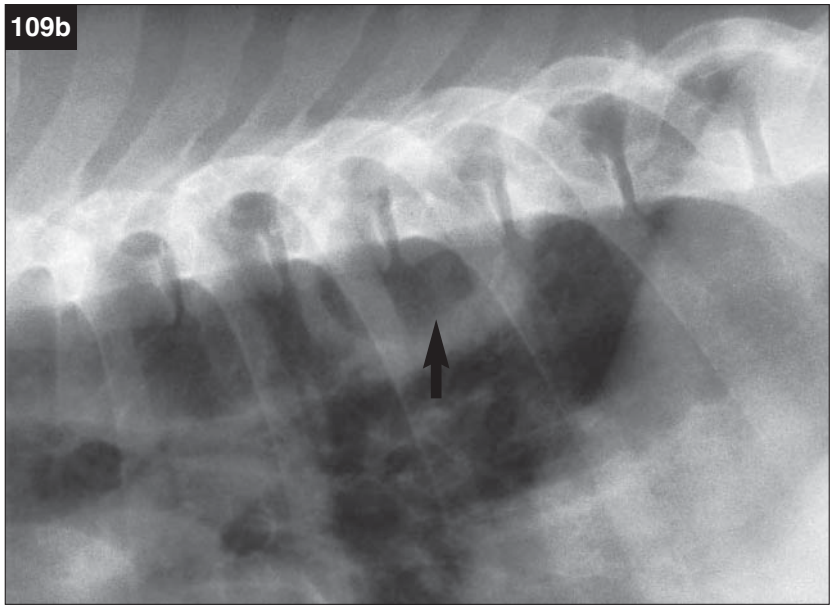
108a–e Pulmonary thrombosis in a cat.
Pulmonary artery thrombosis is a rare disorder in the cat. The cause in this cat was unknown, but the problem was large enough to cause dyspnea and pleural effusion. The radiographs (**108a–c**) show nonspecific pathology, as evidenced by the pleural effusion and thickened right pulmonary artery (arrows), while necropsy confirmed the diagnosis (**108d, e**).

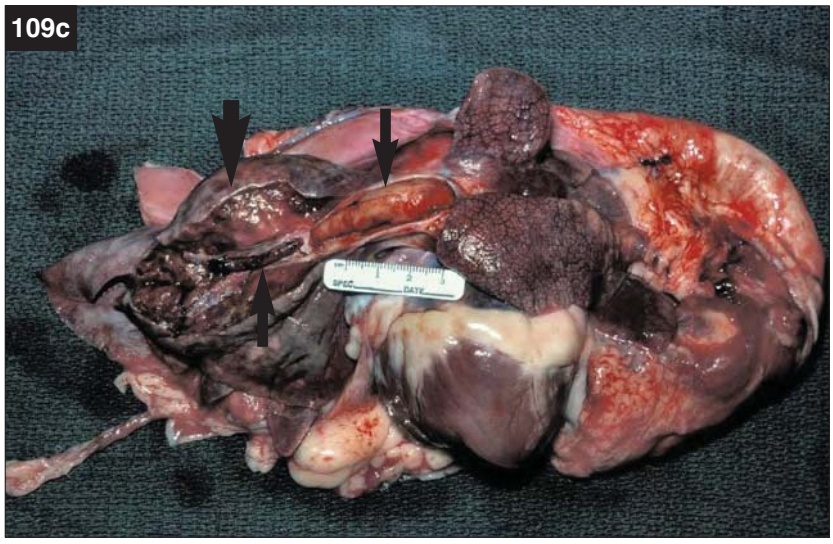

108c


108d

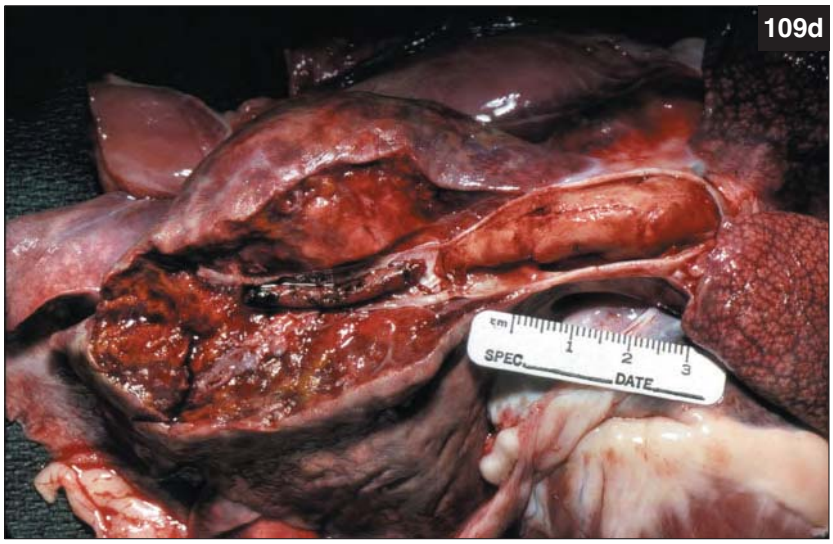

108e







109a–f Pulmonary thrombosis.
The lesions in these radiographs (**109a, b**) and postmortem specimen (**109c–e**) include a right-sided caudal lung lobe abscess (arrows) with an accompanying large pulmonary thrombus. This same dog had renal amyloidosis and hypoproteinemia. At necropsy the kidney was stained with iodine in order to highlight the amyloid laden glomeruli (**109f**). The low protein could have predisposed the dog to thrombus formation (arrows) (because of diminished amounts of antithrombin 3 globulin), which in turn could have influenced the development of the lung abscess (fat arrow).


109d
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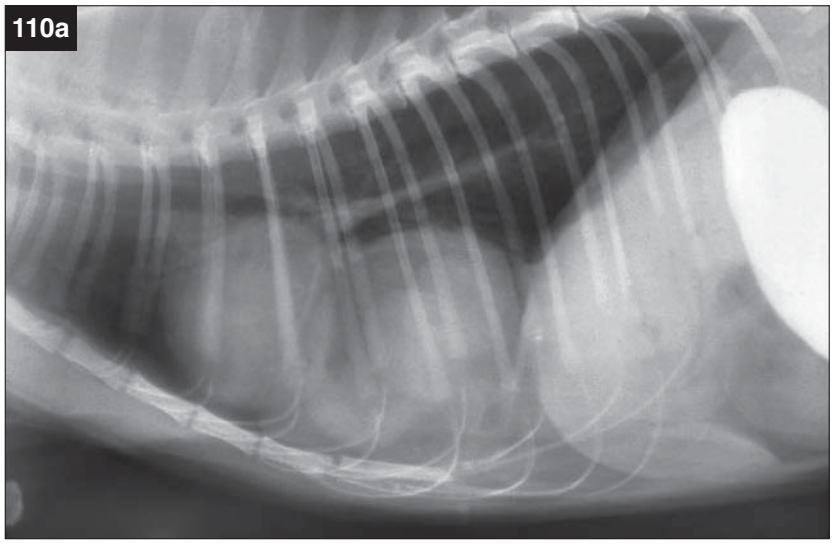
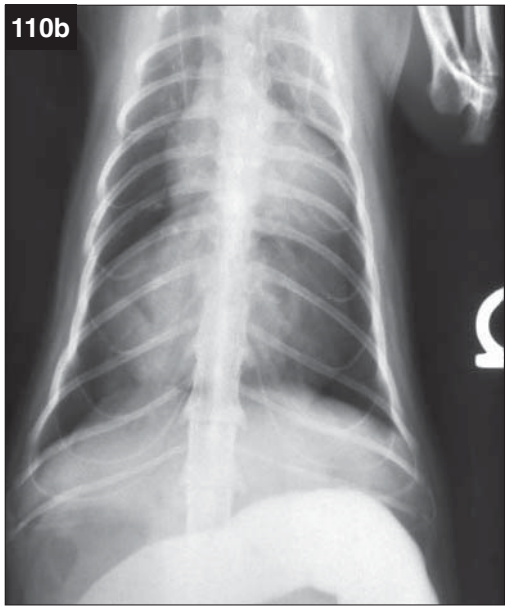
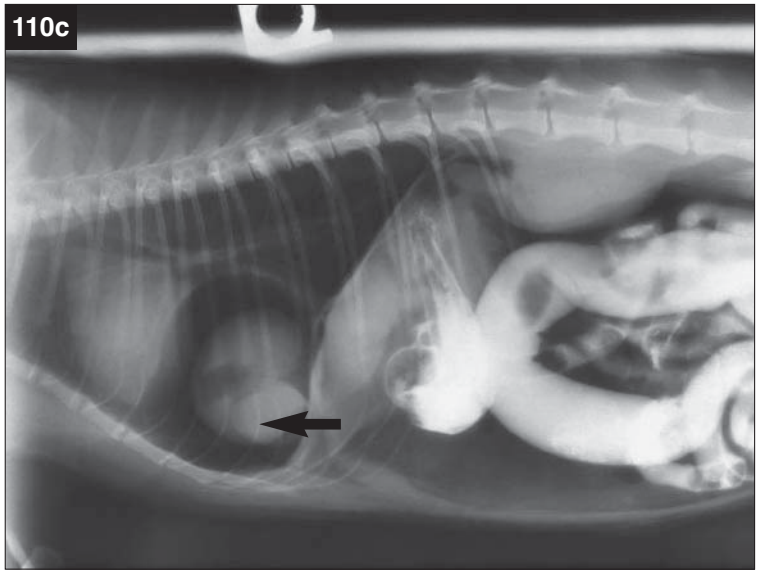
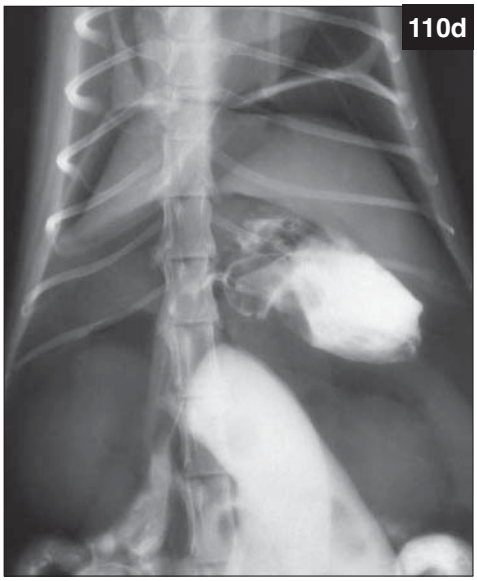


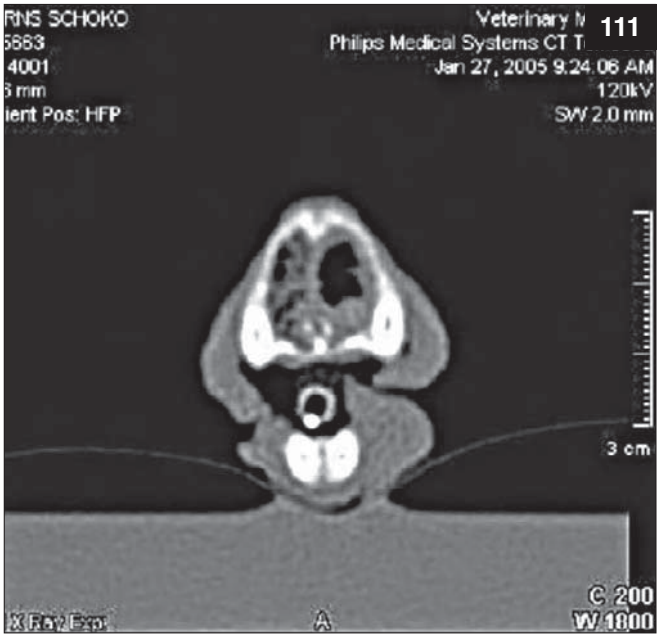


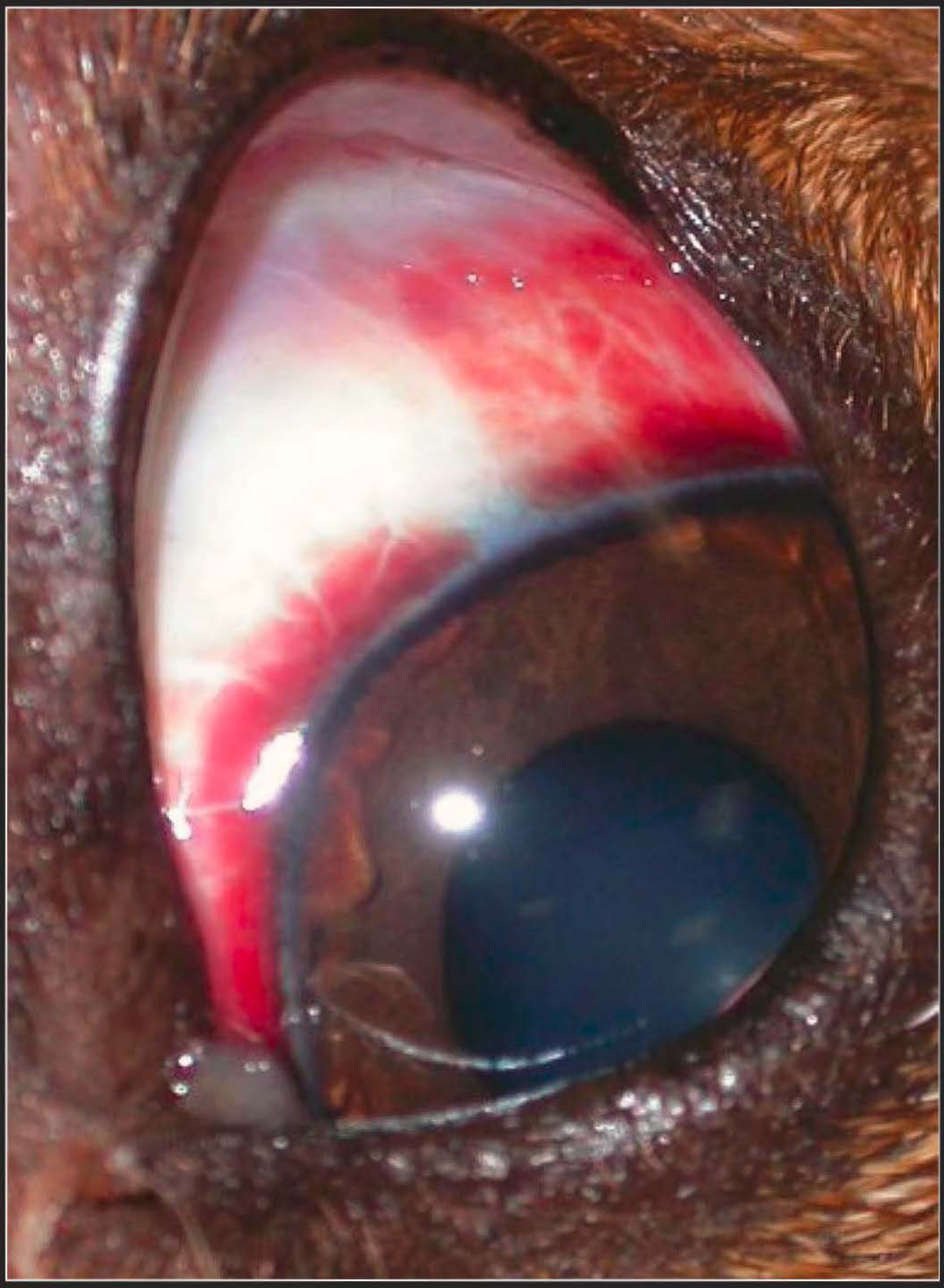


110a–d Peritoneal-pericardial diaphragmatic hernia.
These four radiographs depict a congenital peritoneal-pericardial diaphragmatic hernia. Images **110a** and **110b** are plain films and **110c** and **110d** are double contrast radiographs, where barium was given orally and carbon dioxide was injected into the abdominal cavity. The liver is visible in the thoracic hernia sac (arrow).



111 Rhinitis.
These CAT scans were taken from a cat with ***Bordetella*** species-induced rhinosinusitis. Note the diminished nasal turbinates on the right side. Long-term medical treatment is often necessary, and relapses are common.





6

Hematologic disorders

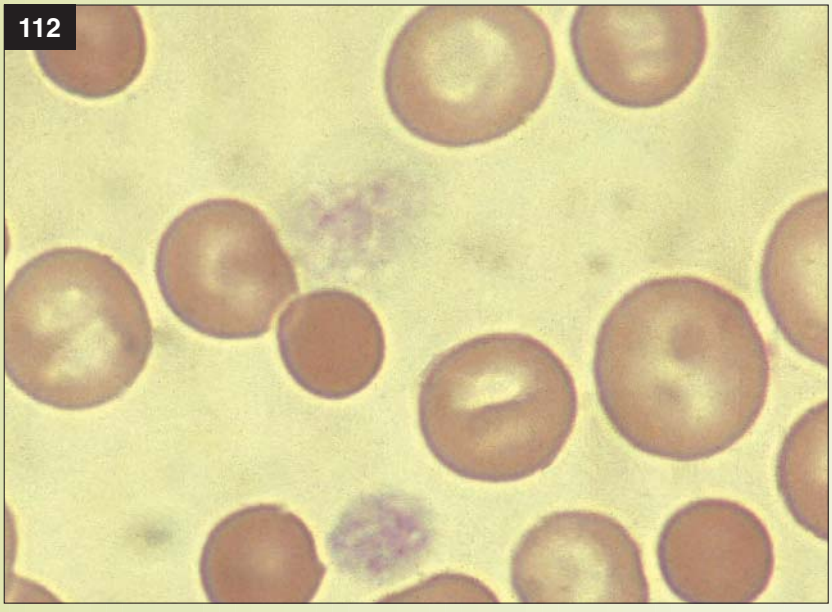
HEMATOLOGY comes from the Greek word ***haimatos***, meaning blood. There is no medical disorder that does not impact on the hematopoetic system, therefore allowing varying amounts of information to be derived from a complete blood count. Hematology can be a primary disorder, as seen with immune-mediated hemolytic anemia, immune thrombocytopenia, or leukemia. It can also play a major role as a secondary disorder that can reach life-threatening proportions as seen in disseminated intravascular coagulation (DIC).

Today, most hematology interpretation is done by a clinical pathologist, but the primary clinician can still derive much useful information by him- or herself, as seen with the determination of macroagglutination, the detection of hemoglobin in serum, and, sometimes, the surprising discovery of abnormal cells, reflecting primary disorders elsewhere in the body. Examples of such abnormalities are illustrated in the following images.

◀ Scleral hemorrhage in a dog.

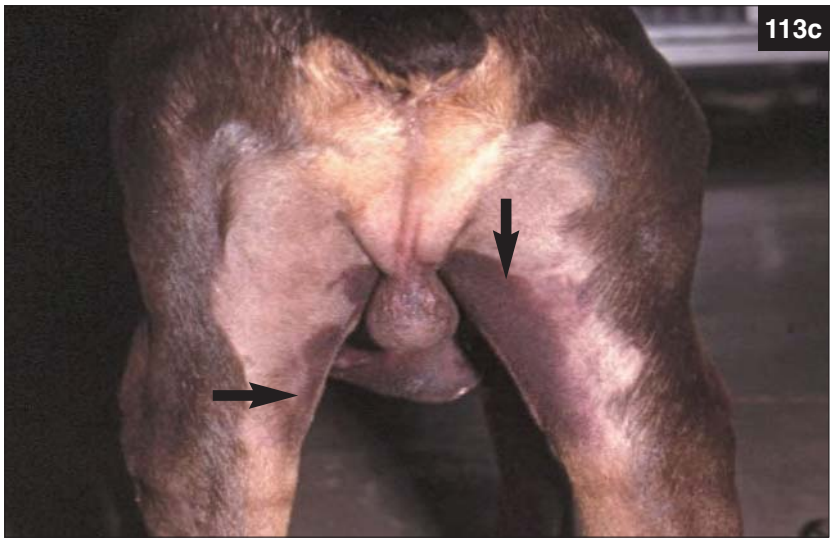
Hematologic disorders

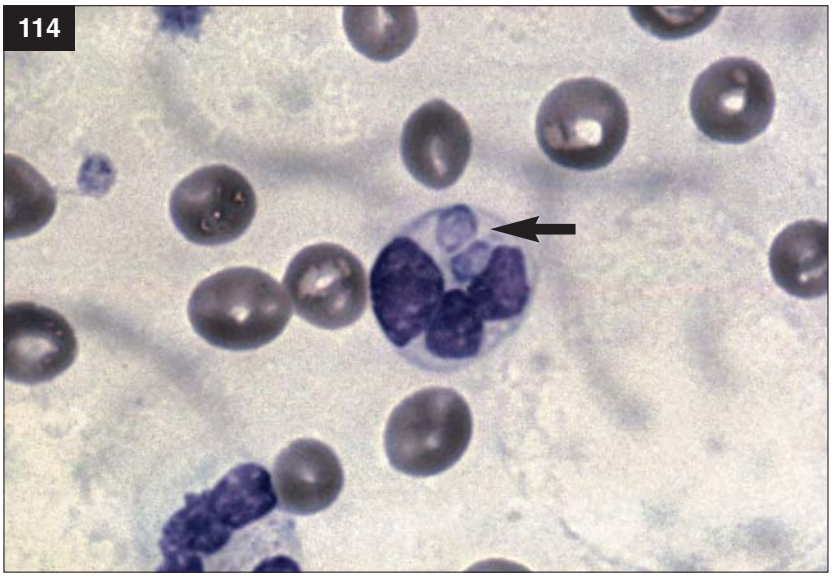
- Unclotted blood in clot tube – consider coagulopathy.
- Massive splenomegaly – splenic torsion, lymphoma, myeloproliferative or mast cell splenic neoplastic infiltrate.
- Thrombocytopenia plus anemia – causes pale petechiae!
- Fleas plus thrombocytopenia – causes 'lots of ' lumbosacral petechiae.
- Low WBCs, low RBCs, low platelets – rule out bone marrow suppression.
- Fulminant hemolysis: anemia, hemaglobinemia, hemaglobinuria, weakness, depression, +/– vomiting.
- Bone marrow derived leukopenic animals don't make pus!
- Keep IMHA and ITP patients on long-term alternate-day maintenance prednisone for 9–12 months.
- Try danazol (Danocrine) with prednisone for refractory IMHA and ITP.
- Observe for autoagglutination and spherocytes in IMHA.
- Newly acquired bleeding – think anticoagulant rodenticide poisoning.
- A normal bleeding time ensures adequate platelet hemostasis; a normal platelet count does not.



112 Spherocytes. These very spherical shaped cells are formed when a part of the antibody coated red blood cell membrane is pinched off in the monocyte–macrophage lined sinusoids of the lymphoreticular tissue. They are typically more round than normal red blood cells. This image is also shown in case **120**. (Image courtesy University of Florida Clinical Pathology Service)

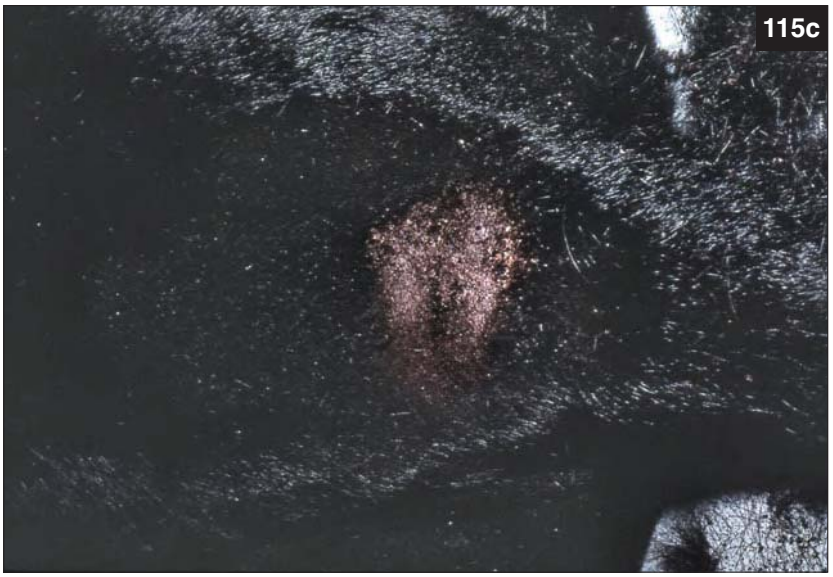
113a–c Von Willebrand's disease.
Failure to determine the bleeding time or a von Willebrand factor determination in a breed predisposed to this disorder can be met with severe bleeding complications following any surgical procedure, as shown in this Doberman Pinscher post castration. Several units of cryoprecipitate were necessary to stop the hemorrhage.

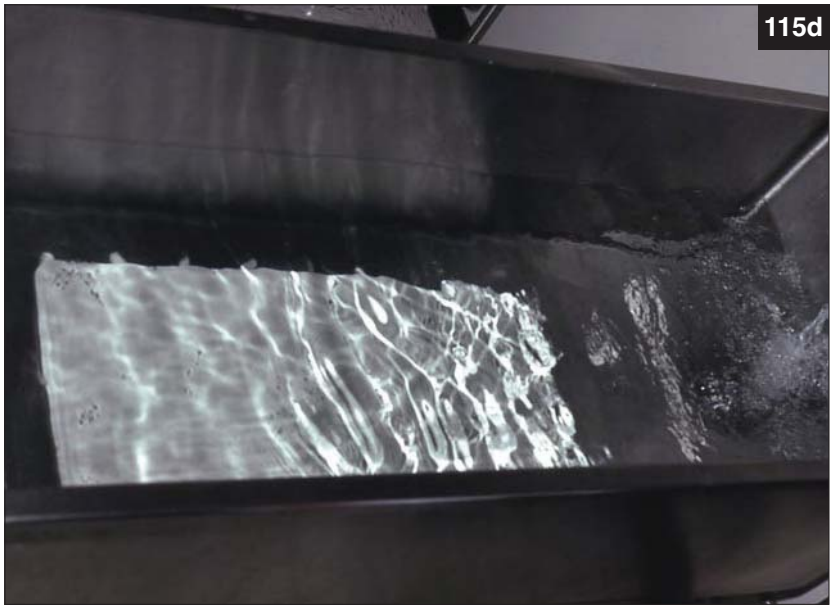




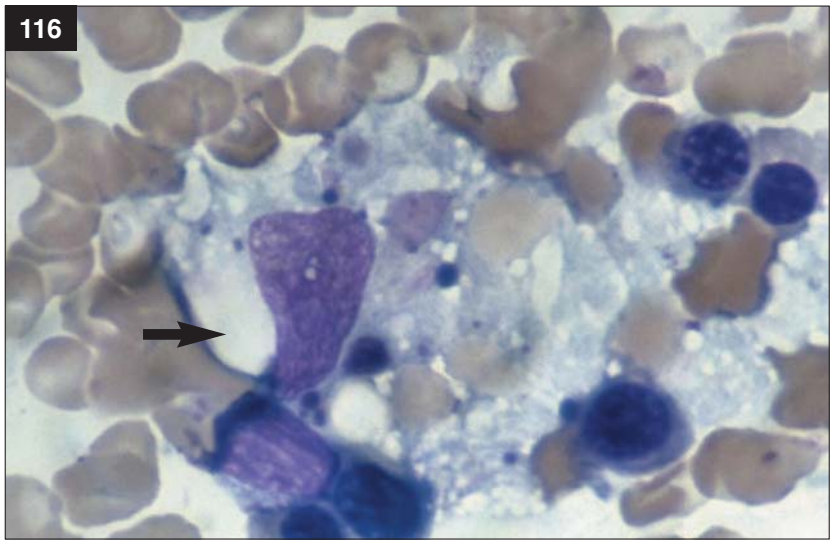
114 Ehrlichiosis.
Shown are ***Ehrlichia canis*** organisms in the macrophages of a dog's blood smear (arrow). When these are undetected on the blood smear, the diagnosis of ehrlichiosis has to be based on the finding of a positive antibody titer. Tetracycline or doxycycline for 2–4 weeks is the preferred treatment. Same image also seen in case **59**. (Image courtesy Dr. J Harvey)

115a–e Flea anemia.
This geriatric Labrador Retriever (**115a**) had severe flea-induced anemia (PCV 0.10 l/l [10%], total protein 48 g/l [4.8 g/dl]. Image **115b** shows pallor and dead fleas. Note how the flea feces containing the dog's digested blood accumulated on the dog's skin (**115c**) and caused the bath water to turn red (**115d, e**). This dog was treated with packed red cells and an oral iron supplement, as well as topical insecticides.

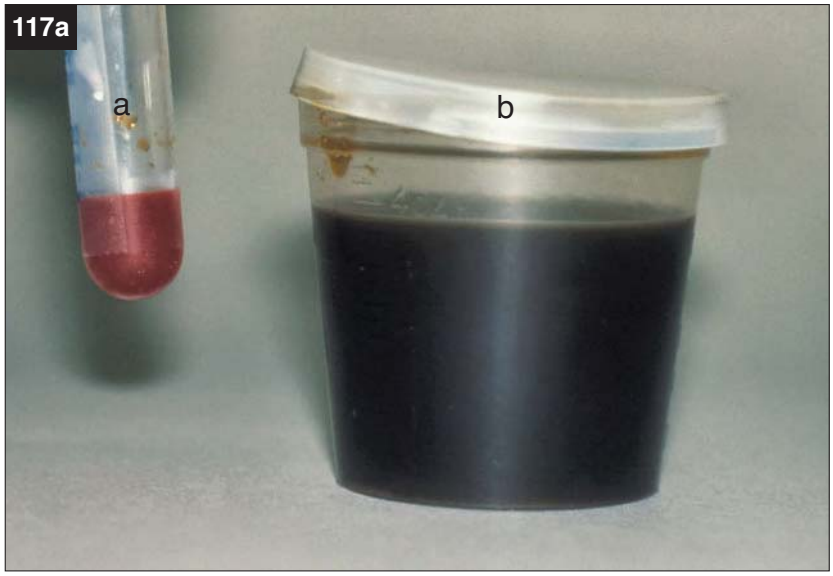

115c


115d


115e



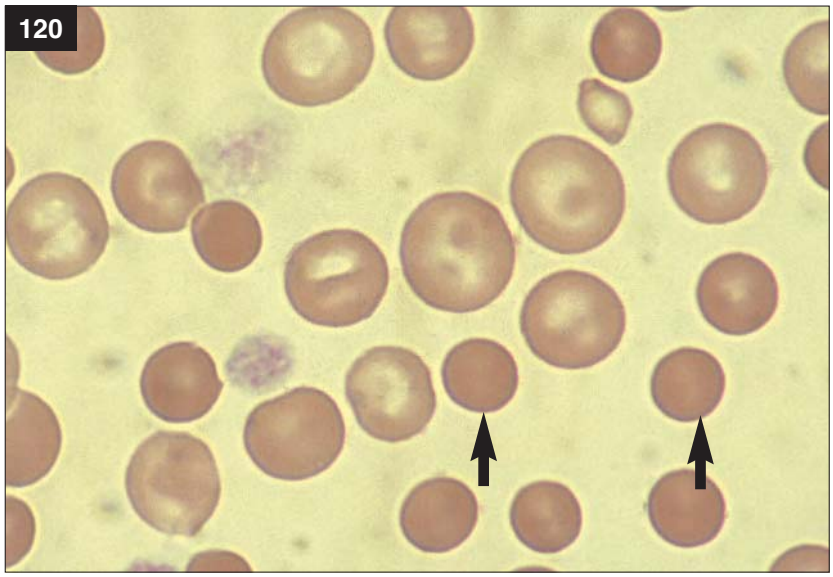
116 Erythrophagocytosis. This image shows a splenic phagocyte ingesting a red blood cell (arrow). The patient was a Dachshund with immune hemolytic anemia and secondary hypersplenism. The dog did not improve until a splenectomy was done. (Image courtesy Dr. J Harvey)



117a, b Hemoglobinemia and hemoglobinuria. Hemoglobinemia and hemoglobinuria are commonly found with acute intravascular hemolytic diseases where the hemoglobin escapes into the serum (a) and urine (b), respectively (**117a**). The dog in **117b** is a 1-year-old Yorkshire Terrier that has acute immune hemolytic anemia, with intravascular hemolysis accounting for its icterus and hemoglobinuria. The PCV of this dog was 0.10 l/l (10%).

118 Hematuria.
Overt hematuria was the only complaint for this particular dog with immune thrombocytopenia, despite the fact that other signs such as petechiations and melena are more common. Such a clinical sign can also occur with a primary renal source of bleeding or a systemic bleeding disorder.

119a, b Pancytopenia: FeLV-induced.
This kitten has petechiae on its pinnae (**119a**) and a conjunctival ecchymosis (**119b**) caused by thrombocytopenia associated with FeLV-induced pancytopenia. The prognosis for this form of the infection is grave.



120 Immune hemolytic anemia.
This blood smear shows spherocytes (arrows) and anisocytosis in a dog with immune hemolytic anemia. Reticulocytes will not occur before day 4–5 of the disease. (Image courtesy University of Florida Clinical Pathology Service)

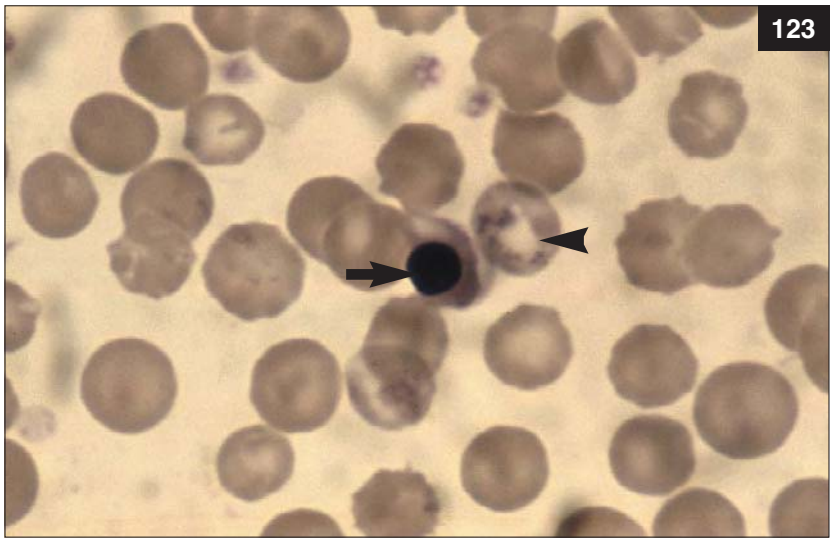
121a, b Immune hemolytic anemia: macroagglutination.
This blood smear with added saline solution shows macroagglutination (**121a**); the microscopic view (**121b**) depicts the same process, thus eliminating rouleau effects. It is caused by the electrostatic charges associated with the complement and antibody coated red blood cells. These are typical changes for immune hemolytic anemia and are as significant as a positive Coombs test. (Images courtesy University Florida Clinical Pathology Service)

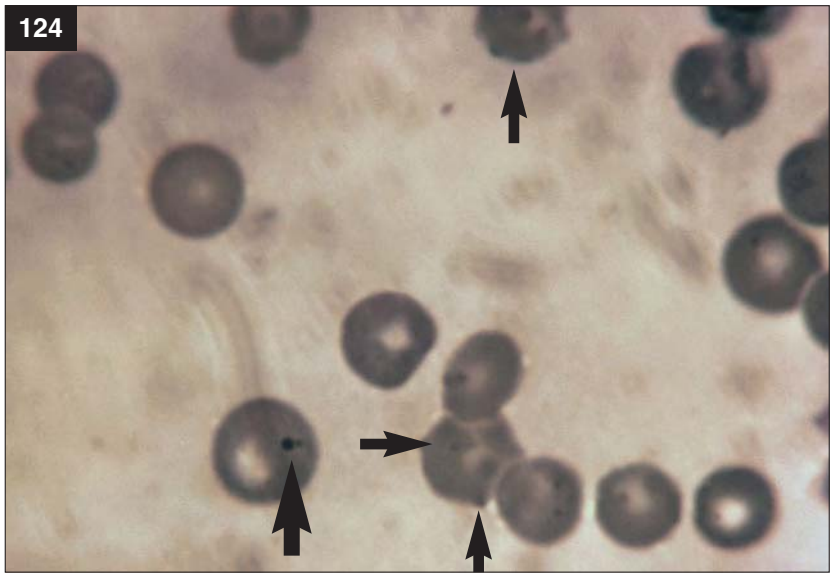
122a, b Heinz body hemolytic anemia.
(Also shown in Toxicology section – case **362**, p. 259) This Siamese cat acquired Heinz body hemolytic anemia from a urinary antiseptic tablet that contained methylene blue, a known cause of this adverse drug effect in cats. Note the blue colored oral mucous membranes caused by the methylene blue (**122a**). The blood smear shows Heinz bodies (arrows) and reticulocytes (arrow head) highlighted by the methylene blue that was in the cat's bloodstream (**122b**).


122a


122b

123 Lead poisoning.
The most common hematologic changes seen with lead poisoning in the dog are the presence of nucleated red blood cells (arrow) and basophilic stippling (arrow head). These changes are always present in cases of plumbism.


123



124 Mycoplasmosis: *Mycoplasma haemofelis*.
This parasite used to be called *Haemobartonella felis.* The parasites are the lighter stained organisms on the red blood cell surfaces (arrows). The darker stained object is a Howell-Jolly body (fat arrow). The acute hemolytic anemia is best treated with doxycycline. Prednisone is sometimes given concomitantly because of suspected autoimmune mechanisms participating in the red cell destruction. (Image courtesy University of Florida Clinical Pathology Service)

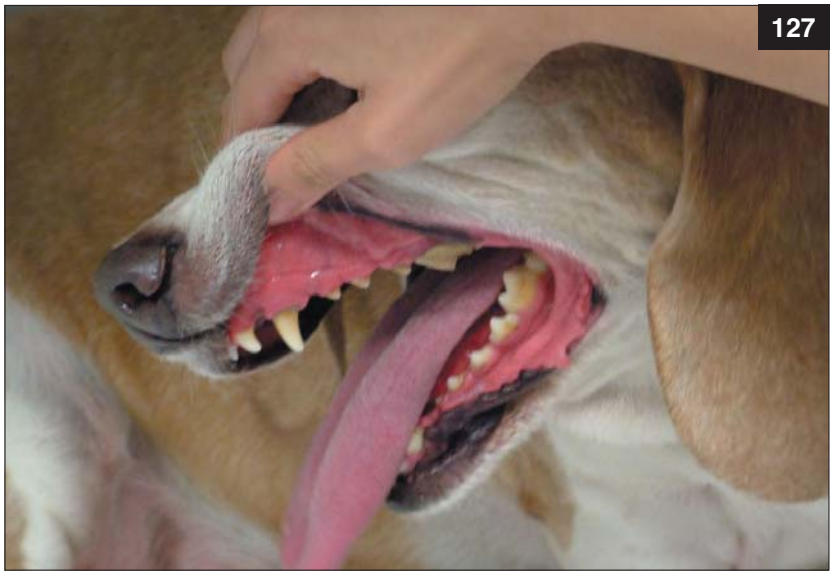
125a, b Petechiae and ecchymoses.
These two images represent petechiations and ecchymoses. The first dog (**125a**) has many petechiae and one ecchymotic lesion that represent ongoing bleeding from this dog's immune thrombocytopenia condition. The second dog (**125b**) shows mainly ecchymoses, which are essentially confluent petechiae.

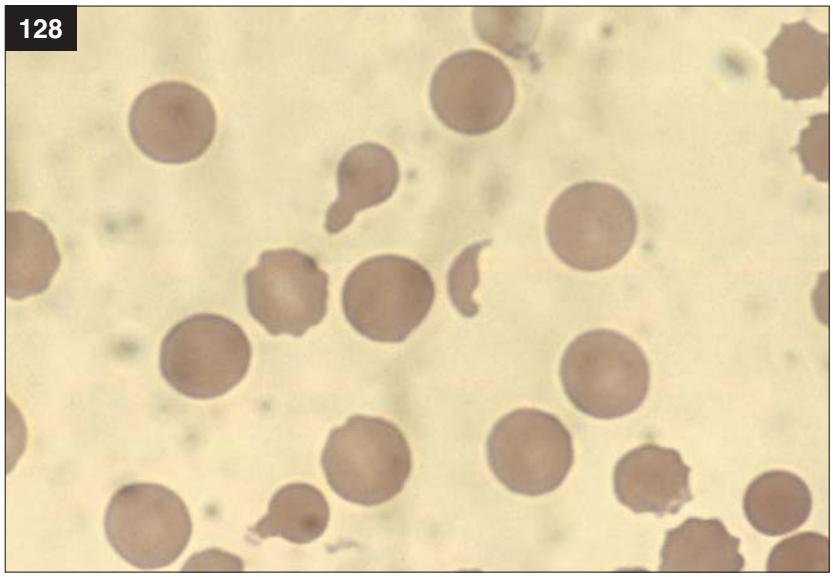
126a, b Petechiae.
This dog (**126a**) shows bright red petechiae because its red blood cell count was near normal. The pale petechiae in the other illustration (**126b**) from a different dog are not as bright because of the dog's more pronounced anemia. 'Pale petechia' can also represent resorbing petechiae.


126a

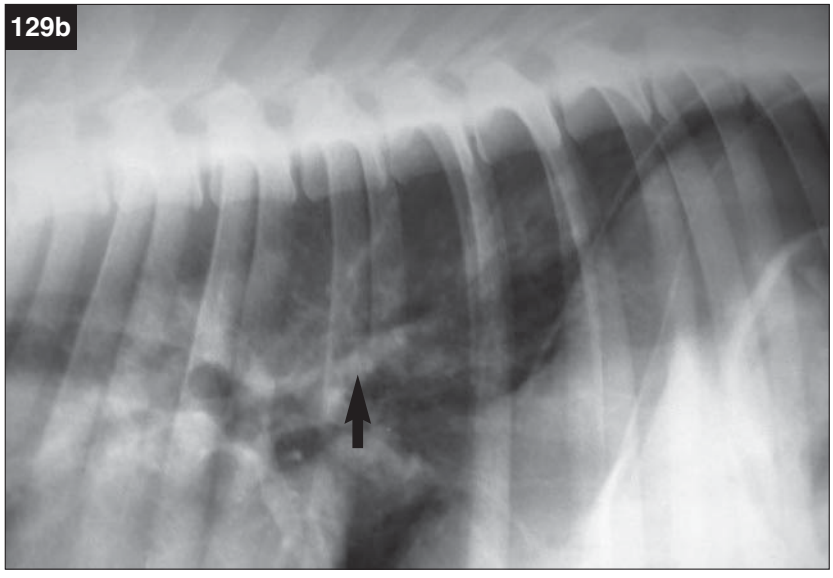

126b

127 Plethora.
This term is derived from the term 'over fullness' and pertains to vascular congestion. This dog has very engorged mucous membranes because of its polycythemia [PCV 0.68 l/l (68%)]. A detailed medical work up would be required to evaluate the type of plethora (primary or secondary) and the exact cause. Phlebotomy is usually done when the PCV exceeds 0.70 l/l (70%).

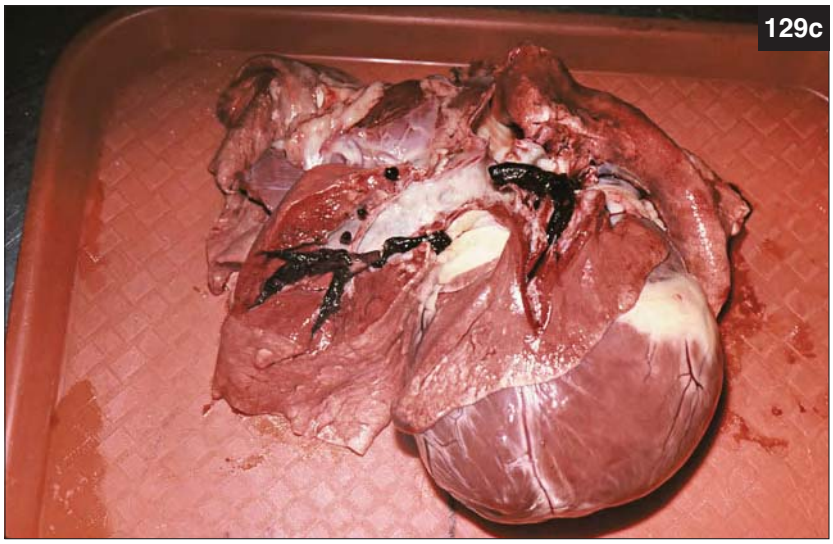

127

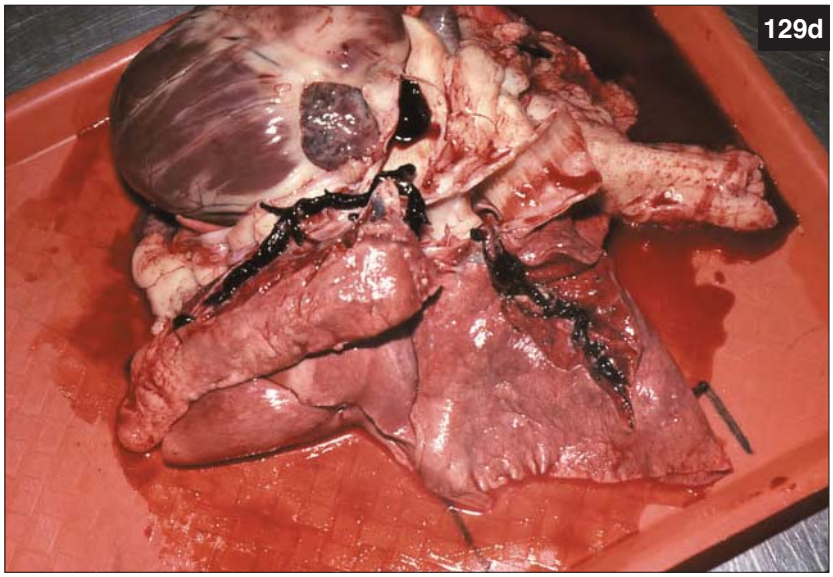


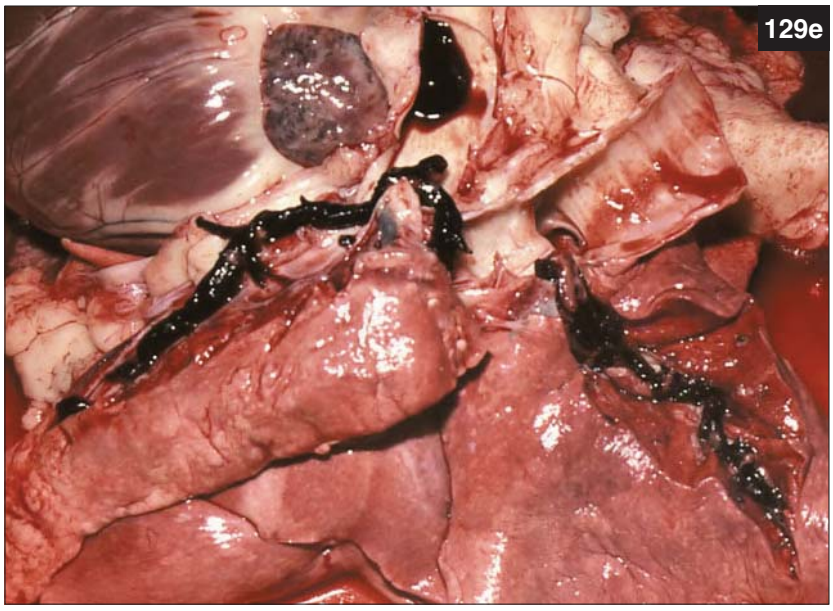
128 Poikilocytosis.
The variation in the shape of these red blood cells can be seen with bone marrow responsive anemias such as immune-mediated hemolytic anemia. (Image courtesy University of Florida Clinical Pathology Service)

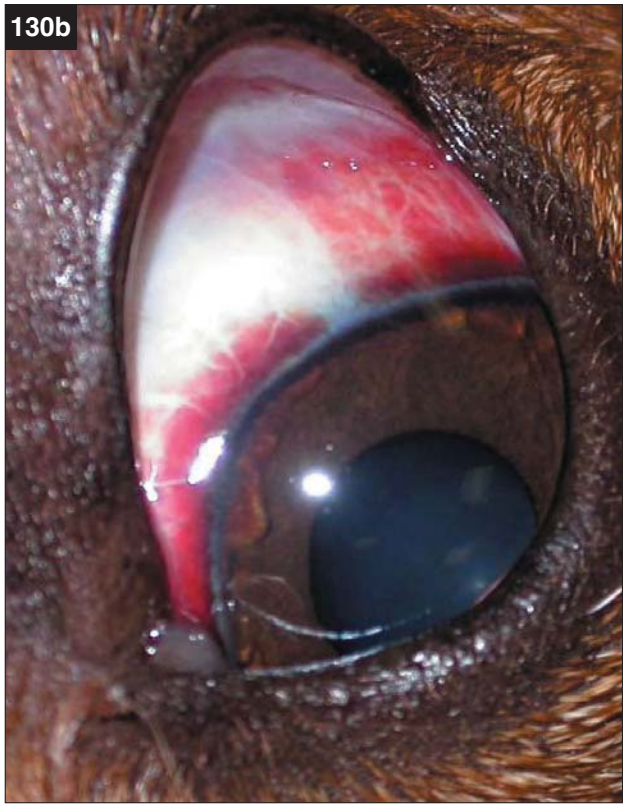


129a–e Pulmonary thrombosis.
This Doberman Pinscher (**129a**) had severe immune hemolytic anemia that required high (2.0 mg/kg q12h) initial doses of prednisone. The thoracic radiograph (**129b**) shows widened and blunt ending pulmonary arteries (arrow) representing pulmonary thromboses that formed as a result of the procoagulant effects of the glucocorticoid drug. Postmortem examination revealed massive and diffuse pulmonary artery thrombus formation (**129c–e**).


129c


129d

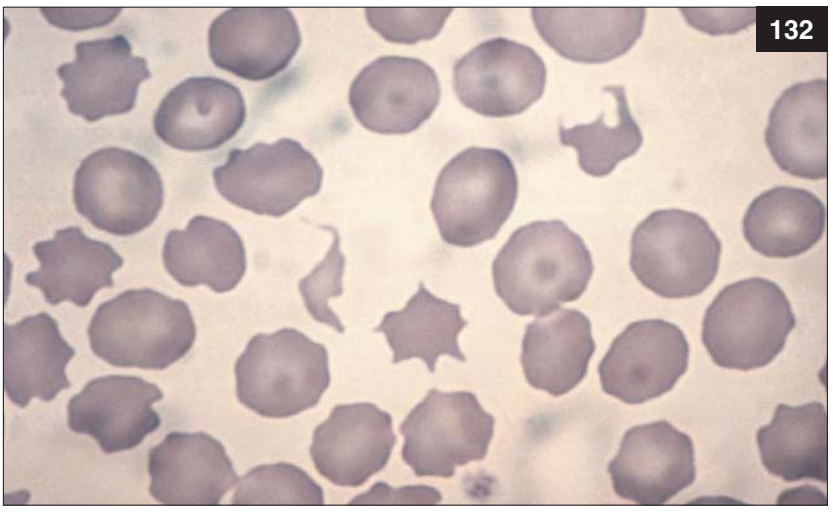

129e

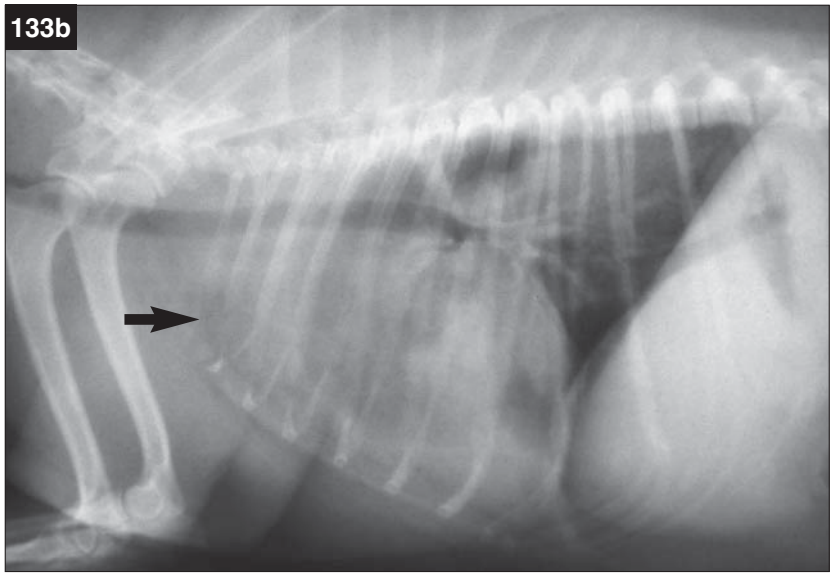


130a, b Thrombocytopenia. The low platelet count in this dog caused its diffuse petechiae (**130a**) and scleral hemorrhage (**130b**). A platelet function defect can cause the same lesions.

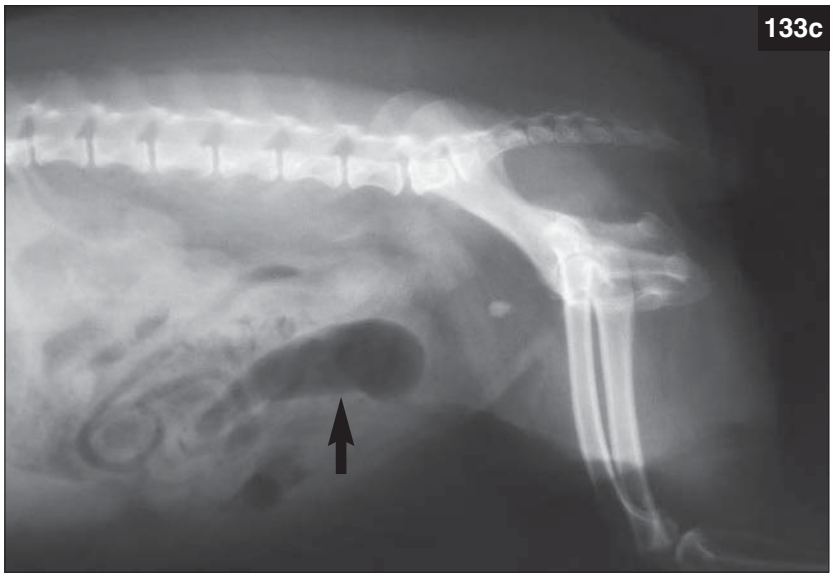
131a, b Thrombocytopenia and fleas.
This dog was diagnosed with immune thrombocytopenia. At the time of its initial examination, the majority of its petechiae were located over the lumbar skin region, which happened to be populated by a large number of fleas. The petechiae represented the sites of the flea bite. These images were taken after the fleas had been removed with an insecticide bath.

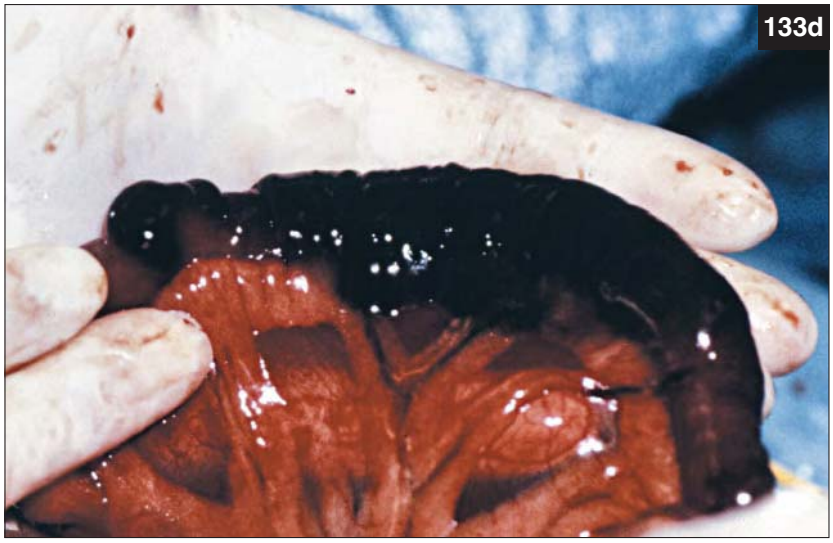
132 Schistocytes.
These are fragmented red blood cells that can occur in hemolytic anemias or in conditions that allow fibrin to form in the blood vessel lumen (e.g. DIC), which causes the red blood cells to fragment as they circulate through. (Image courtesy University of Florida Clinical Pathology Service)





133a–d Anterior vena cava syndrome.
This Schnauzer was treated with immunosuppressive doses of prednisone for immune-mediated hemolytic anemia (**133a**). The glucocorticoid caused a prothrombic effect that allowed for the formation of a thrombus in the anterior vena cava (arrow), as depicted by the anterior mediastinal density on the lateral radiograph (**133b**). This impaired venous and lymphatic drainage from the head, causing it to undergo lymphedema. A thromboembolus also formed in the arterial circulation, which caused a mesenteric artery occlusion and small bowel infarction (note the abnormally gas distended bowel segment (arrow) on the radiographic [**133c**] and surgical [**133d**] views of infarcted bowel) and led to catastrophic results for this dog postoperatively. The urinary bladder calculus in **133c** is an incidental finding.


133c


133d

7

Gastrointestinal disorders

GASTER is derived from the Greek words ***gaster***, meaning stomach or belly, and ***enteron***, meaning intestines. Gastroenterologic disorders compose a number of syndromes that are commonly seen in practice. Many are easily diagnosed, while others can be amongst the most difficult diagnostic challenges. Although gastroenterology refers to the stomach and the intestines, the discipline also includes disorders of the pancreas and liver, thus causing it to have a respectable volume in any of today's textbooks of medicine.

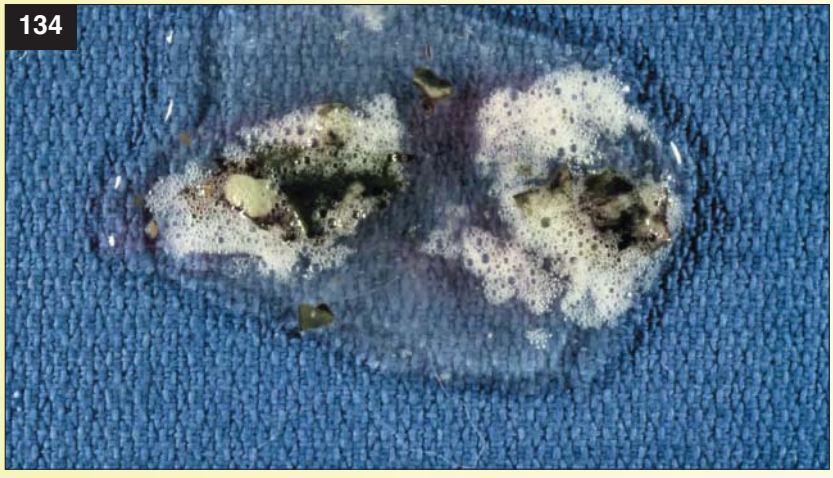
Most experienced clinicians begin their evaluation of the GI tract with a thorough history and physical examination. The history should inquire about any vomiting and diarrhea, and the details of these abnormalities should be provided. A thorough dietary history is also important. The routine medical work-up entails a complete blood count; a serum chemistry panel including serum electrolyte levels; fecal examination for evidence of parasites; and various specialized tests such as trypsinogen-like immunoassay, pancreatic lipase immunoassay, vitamin B12 serum concentration, and several others that can be found in any of the standard textbooks. Diagnostic imaging commonly involves radiology, abdominal ultrasonography, and endoscopy. It is essential for the clinician to biopsy any tissues when the diagnostic evaluation offers that opportunity. The images that follow illustrate the diverse pathology and the means of diagnosing many of the disorders that involve the GI system.

◀ Icterus in the dog

7

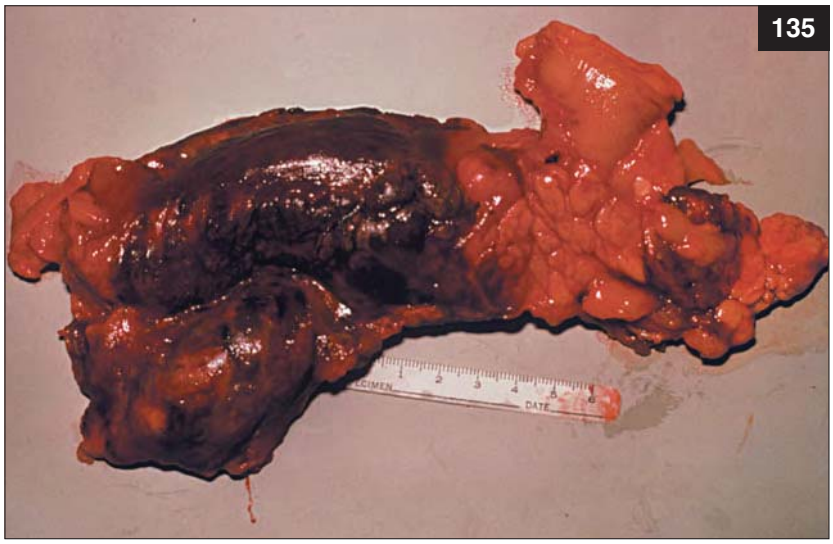
Gastrointestinal disorders

- GI obstructions – main signs are vomiting and anorexia.
- Acute excruciating abdominal pain (like never before seen!) – consider bowel infarction and intestinal volvulus.
- Causes of coffee ground vomitus: gastric ulcers (primary/secondary), uremic gastritis.
- Causes of melena: upper GI lesion, thrombocytopenia.
- Occult blood loss – think GI.
- Melena detection – 'Let your finger do the walking'.
- Black stools: upper GI bleed, thrombocytopenia, swallowing blood, Pepto-Bismol (bismuth subsalicyclate), iron, charcoal.
- Elevated BUN plus normal creatinine – consider upper GI bleed, especially if kidney can concentrate urine.
- Bile in vomitus signifies pyloric patency.
- The lower the obstruction, the more feculent the vomitus.
- Sudden mental depression 2–3 days post enterotomy – rule out dehiscence and sepsis.
- Never let the sun set on a linear foreign body intestinal obstruction.
- Diffuse inflammatory bowel disease can often be diagnosed with distal colon biopsy.
- Sepsis can cause cholangiostasis.
- Gas in the gall bladder is bad and is a surgical disease.
- Bilirubinuria in cats signifies liver disease or intravascular hemolysis.
- J-tube feeding for managing the prolonged period of NPO in pancreatitis can be beneficial.
- Look for pancreatic pathology when the right kidney is easily visible on the radiograph.

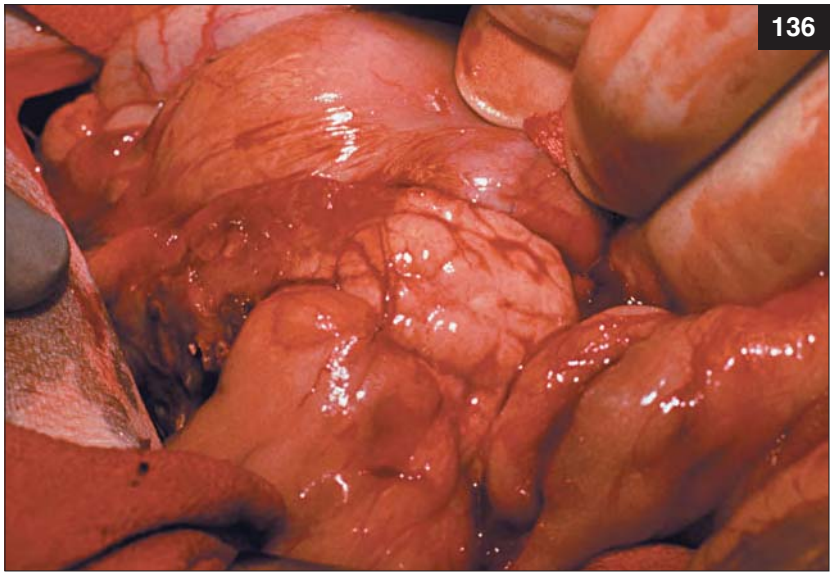


134 Esophageal/gastric vomitus.
This foamy mucoid clear vomitus is typical for either esophageal or gastric origin. The plant fragments are evidence of what caused the animal to vomit.

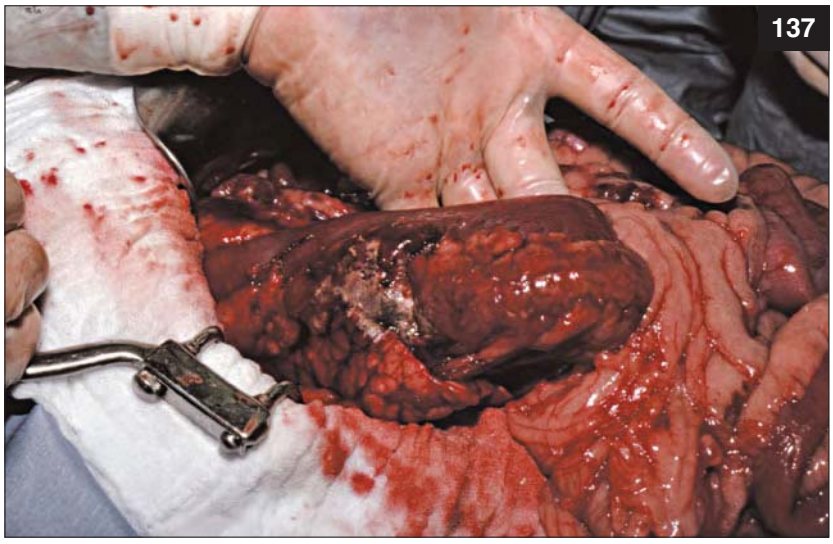
135 Acute necrotic pancreatitis.
This postmortem pancreas specimen is partially necrotic. This is almost always associated with a guarded to grave prognosis because of accompanying systemic inflammatory response syndrome (SIRS) that can progress to become multiple organ dysfunction syndrome (MODS) and lead to the ultimate demise of the patient.

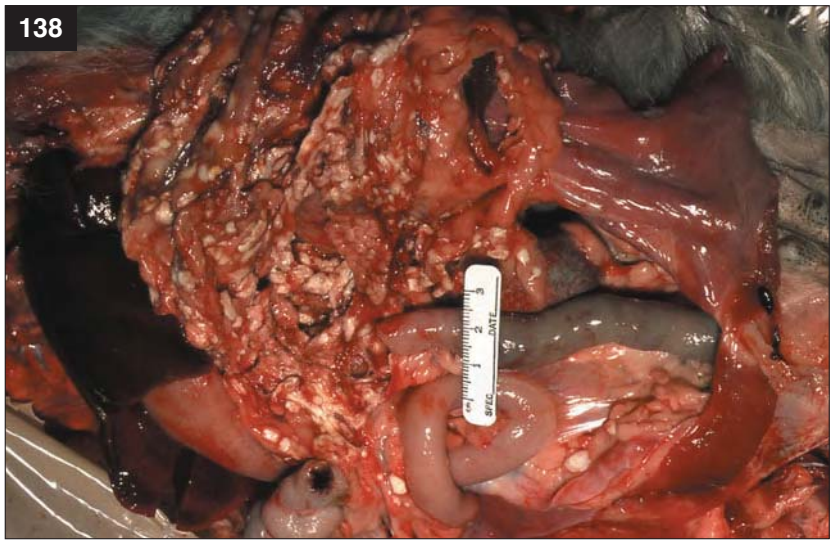


136 Acute hemorrhagic pancreatitis.
This surgical view shows combined hemorrhagic and edematous pancreatitis in a dog. Surgery was done for disease verification and further possible treatment because the signs did not abate after 7 days in intensive care. Surgery provides the opportunity for abdominal lavage and the insertion of a jejunostomy feeding tube that will benefit the patient postoperatively.

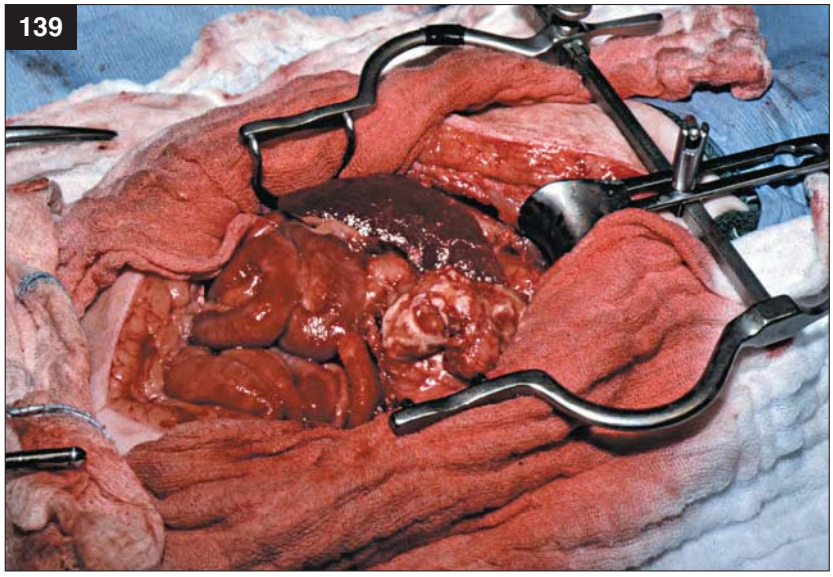


137 Acute hemorrhagic-necrotic pancreatitis.
Dogs with this type of pathology always have a guarded to grave prognosis because of the systemic inflammatory response and/or multiple organ dysfunction that can ensue. Secondary complications are many and include diabetic ketoacidosis, sepsis, DIC, and acute renal failure, just to name a few.





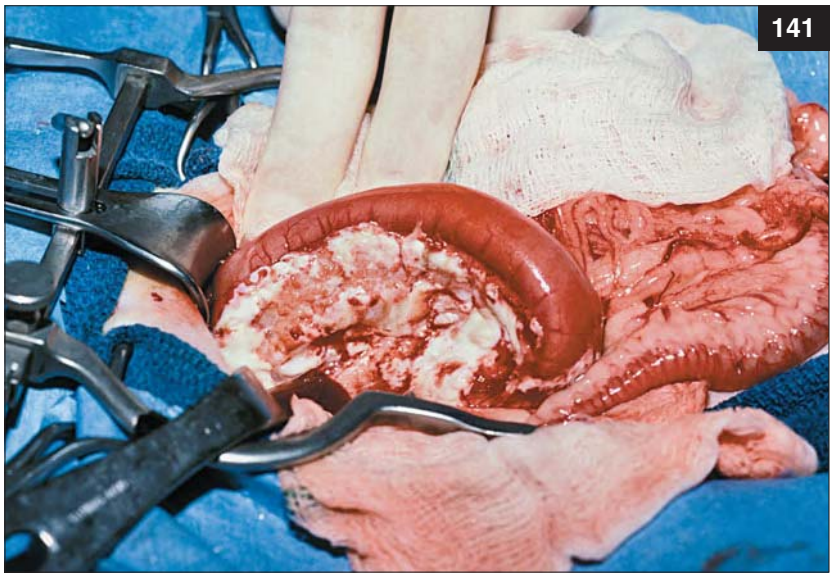
138 Acute pancreatitis: calcium soap.
This postmortem examination shows widespread white mineral deposits representing diffuse calcium soap formation involving the omentum and mesentery in a Lhasa Apso with acute pancreatitis. Every surgeon should be able to recognize the significance of this pathology.



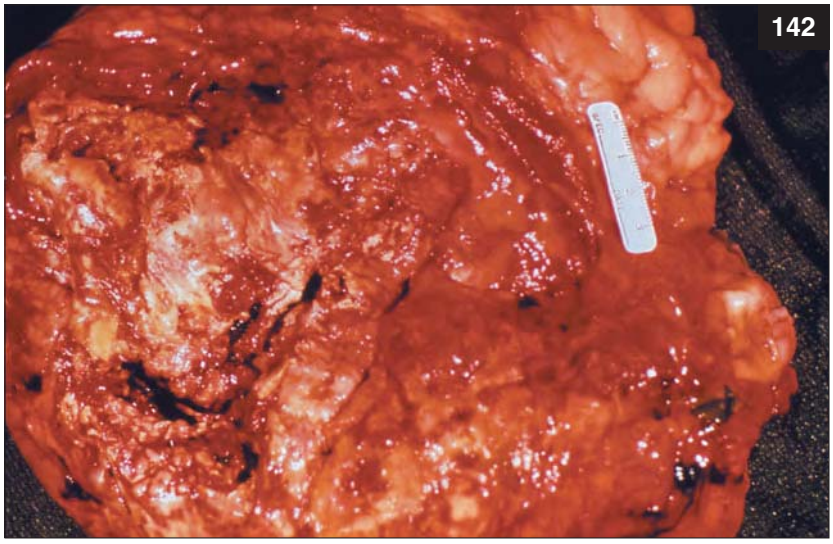
139 Acute pancreatitis and peritonitis.
Note the firey red peritonitis that often accompanies severe forms of acute pancreatitis, as shown in this cat's surgical exploratory. The cat recovered because of good patient care, which included intensive care and a jejunostomy feeding tube that was placed during the surgery and used for providing vital nutrition for 2 weeks postoperatively.

140 Acute abdominal pain from acute pancreatitis.
This male Doberman Pinscher is showing a tucked abdominal posture that reflects his abdominal pain. Narcotic analgesic drugs such as buprenorphine and butorphanol will benefit this dog greatly.

141 Acute pancreatitis.
Acute pancreatitis in the cat can have many of the same features found in the dog. This surgical view of acute pancreatitis in a cat shows extensive calcium soap formation on and surrounding the inflamed pancreas. A lymphocytic–plamacytic form can also occur in the cat.

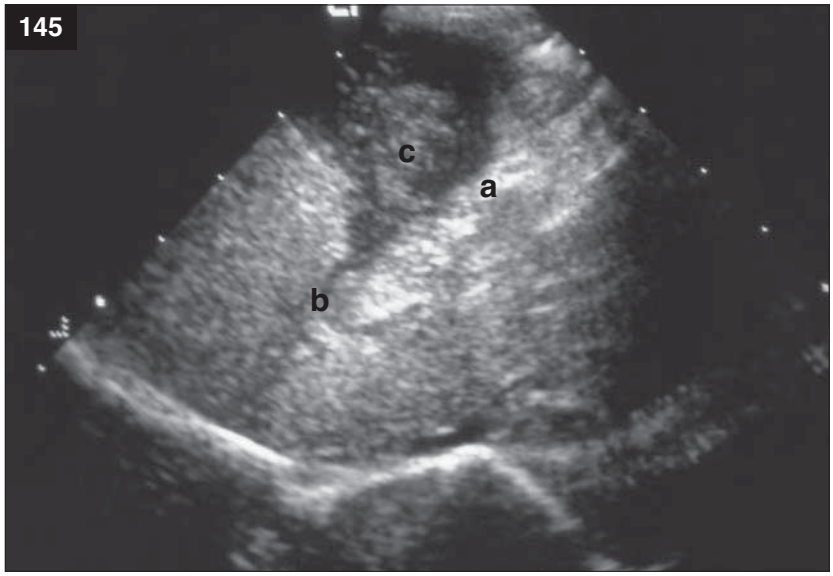


142 Acute pancreatitis phlegmon.
A phlegmon is a spreading suppurative inflammatory response. In pancreatitis it appears as a mass of inflammatory tissue containing mesentery, omentum, and parenchymal tissue. Secondary bacterial infection can involve this tissue.

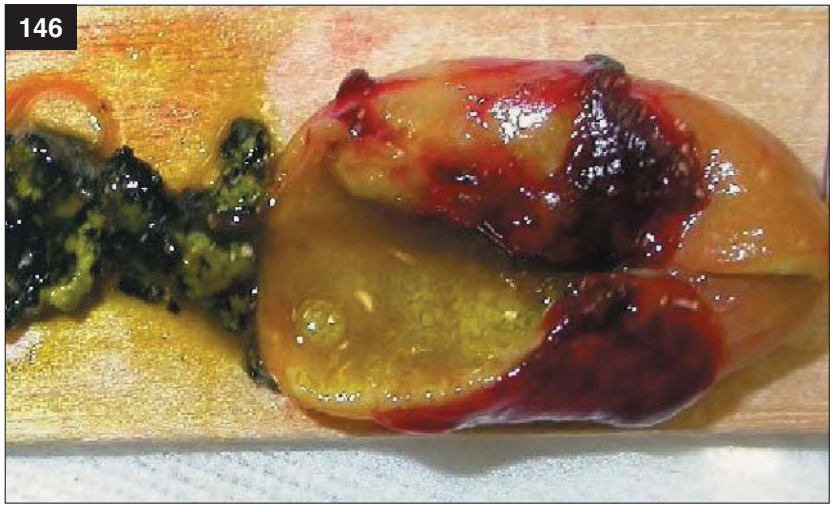


143 Acute pancreatitis.
The abdominal pain with acute pancreatitis can be almost intolerable, as shown by this Poodle's tucked abdominal posturing. Narcotic analgesics (and softer bedding!) would be indicated for this patient.

144 Biurate crystals.
This image is a microscopic view of ammonium biurate crystals in the urine of a dog with a congenital portavenous anomaly. Fasting and postprandial bile acids are characteristically elevated in this disorder.



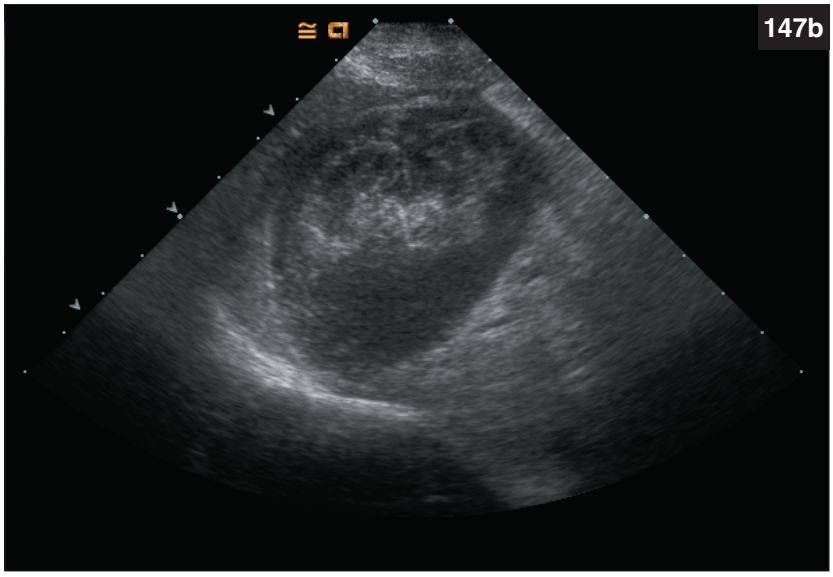
145 Cholecystitis ultrasonogram.
Ultrasound examination of the liver is a very useful diagnostic tool. This particular image depicts gall bladder wall and common bile duct thickening (a), common bile duct occlusion (b), and inspissated bile within the gall bladder (c). Surgery will be necessary.

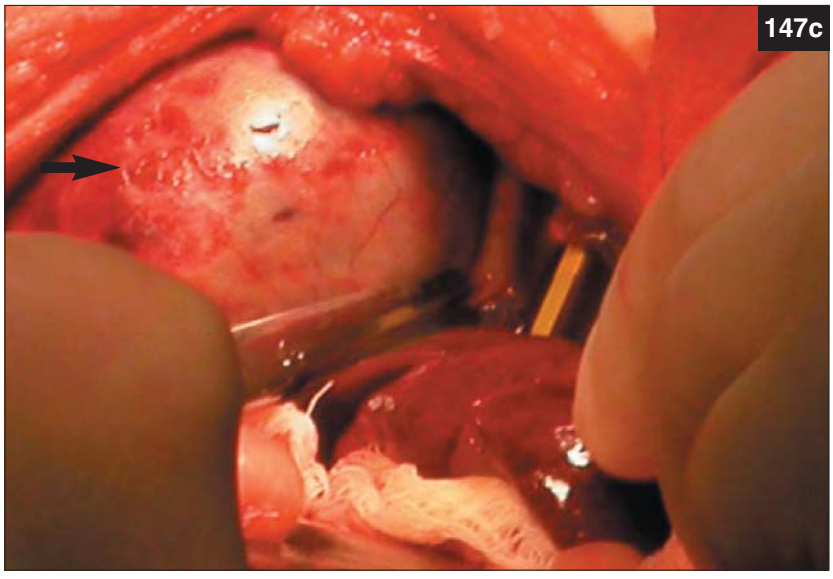


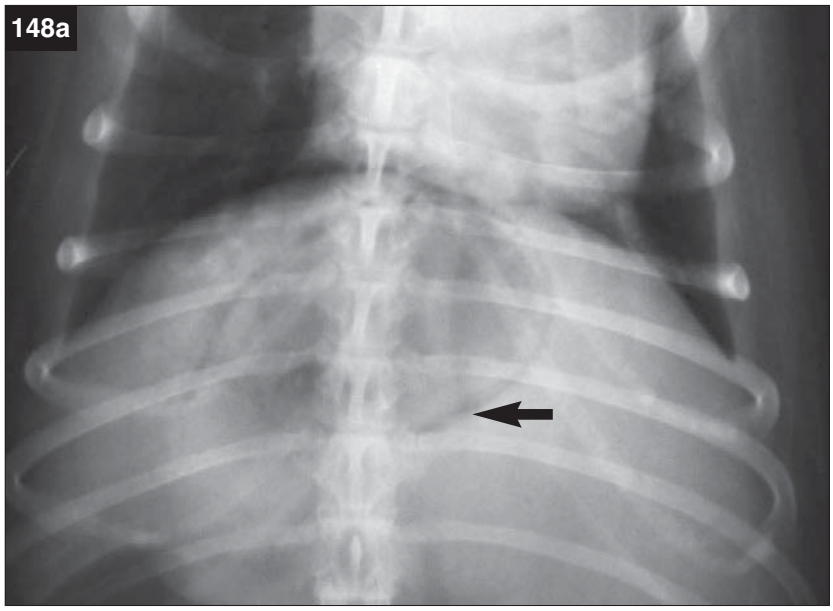
146 Cholecystitis and gall stones.
Gall stones had formed in this dog, causing an obstructed and inflamed gall bladder (note the abnormal tan color of the gall bladder). These lesions are also depicted on the accompanying abdominal ultrasound examination (see case **147a, b**).

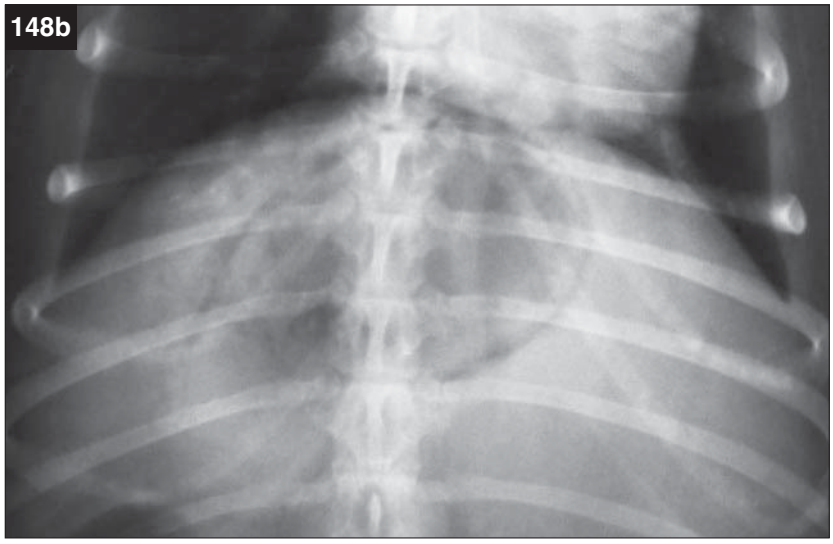
147a–c Cholecystitis. Ultrasound examination (**147a, b**) assisted with the diagnosis of gall bladder mucocele and bile outflow obstruction from the gall bladder (note the distended common bile duct). Cholecystitis (arrow) was confirmed at surgery. Postoperative pancreatitis occurred (**147c**), but the dog eventually did well.

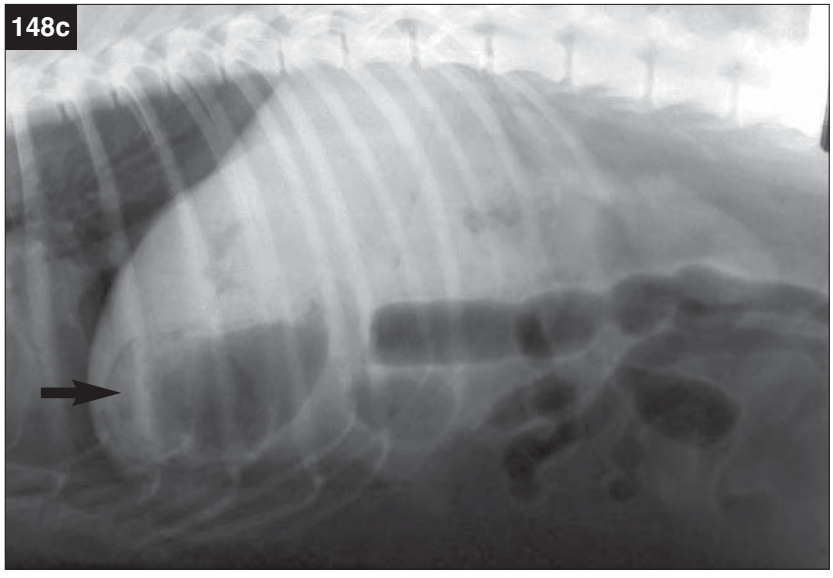

147a


147b


147c



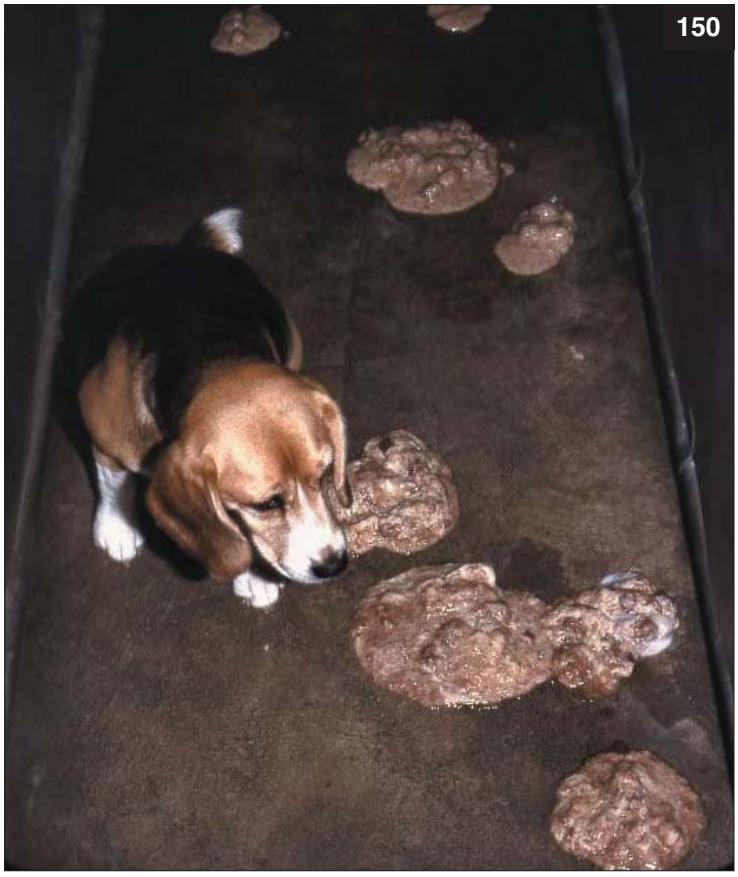




148a–c Cholecystitis (emphysematous): radiography.
These radiographs show a gas-filled gall bladder (arrows) associated with emphysematous cholecystitis, which is a surgical emergency. The gas is produced from gas-forming bacteria such as ***E. coli, Klebsiella*** species, and ***Enterobacter*** species.

149 Cholecystitis (emphysematous): surgery. At surgery, the dog in case **148** had a severely inflamed gall bladder that was partially gangrenous. It also contained inspissated bile. A complete cholecystectomy was done. Attempting to suture this gall bladder closed and replacing it into the abdomen is an invitation for postoperative dehiscence and bile peritonitis.

150 Gastric distension. Apomorphine administration allowed this Beagle to vomit three loaves of bread, which it had mischievously ingested soon after the owner's return from the food market. Its initial signs were restlessness, increased salivation, and, according to the owner, an 'expression of distress' due to acute gastric dilatation. Passing a stomach tube would not have helped this dog.



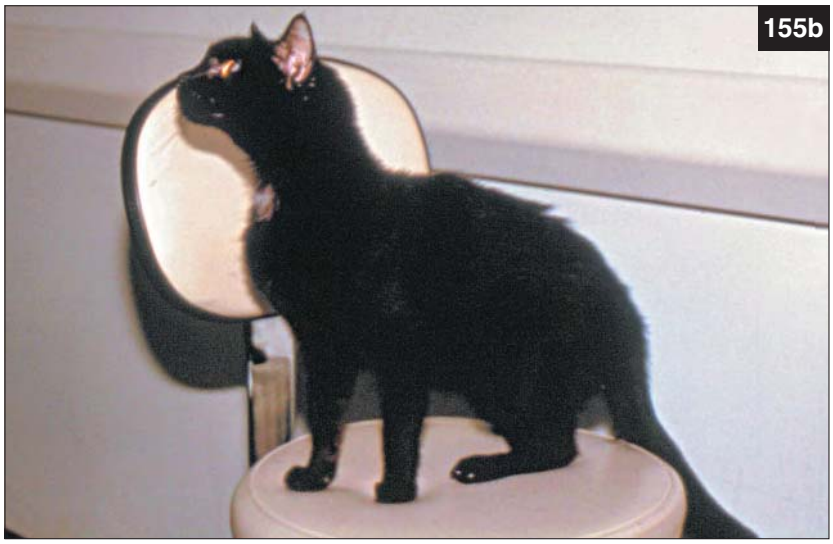
151a–c Esophageal stricture and doxycycline-caused esophagitis. Endoscopic views of an esophageal stricture in a cat before (**151a**) and after (**151b**) therapeutic balloon dilatation are shown. Certain oral medications such as doxycycline and clindamycin tablets and capsules can cause this lesion, which can be prevented by following the drug administration with 10 ml of water by mouth. The hemorrhage is the expected outcome of a successful procedure that will probably have to be repeated 2–3 more times. **151c** depicts esophagitis and esophageal ulcers caused by oral doxycycline tablets. These can also be prevented by following the drug administration with approximately 10 ml of water by mouth.

152a, b Esophageal foreign body.
The two endoscopic views of this dog's esophagus show an impacted green colored, commercially sold dog treat that required a thoracotomy for removal. Shown are views of the foreign body before (**152a**) and after (**152b**) failed attempts to remove it endoscopically (note the fragmentation and the mucosal erosion from the esophagitis). The dog died postoperatively from aspiration pneumonia. Today's improved products should prevent this kind of complication.

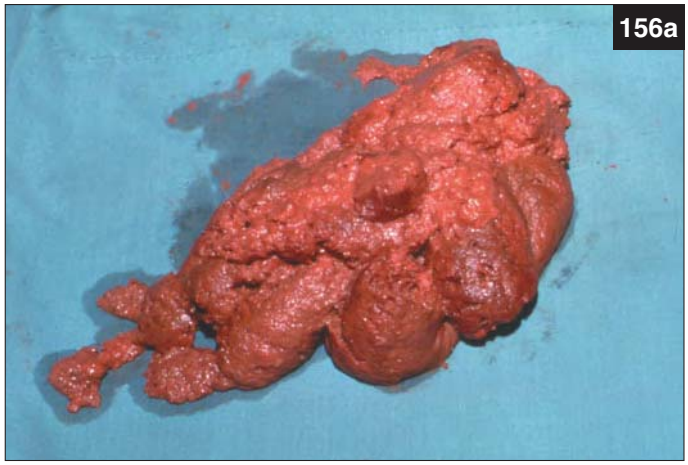
153 Esophagitis.
Esophageal inflammation can be due to gastric acid reflux, ingestion of irritating substances, and faulty passage of a stomach tube. The hyperemia depicts the areas of inflammation. Sucralfate suspension and many of the available antacid drugs such as H_2-blockers and proton pump blockers are effective treatments.

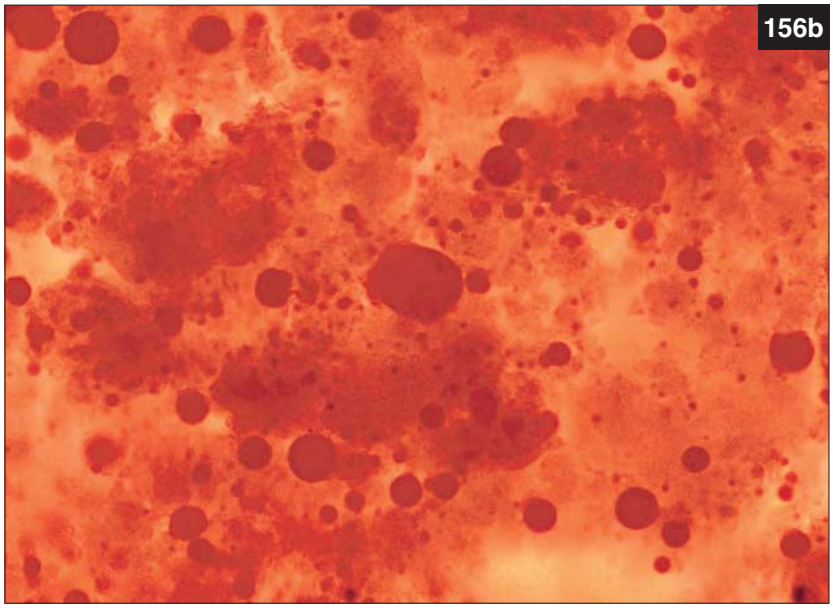
154a, b Exocrine pancreatic insufficiency: dog.
Cachexia from malnutrition can be extreme, as shown in this Dachshund with exocrine pancreatic insufficiency (EPI) that impaired the normal food digestive processes. Shown is the dog before (**154a**) pancreatic enzyme supplementation and approximately six months after treatment (**154b**), which will be required life long.

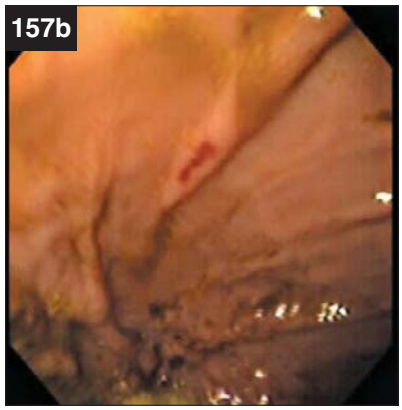
155a, b Exocrine pancreatic insufficiency: cat.
Cats can also have EPI, as shown in these images taken before (**155a**) and after (**155b**) pancreatic enzyme supplementation. Patients with EPI might become diabetic if they lose 70% of their beta cells.


155b

156a, b Exocrine pancreatic insufficiency: steatorrhea. This is a fecal sample from a dog affected with EPI. Note the large volume and the greasy appearance caused by steatorrhea (**156a**), which is shown as the reddish stained undigested fat globules on the microscopic fecal smear (**156b**).

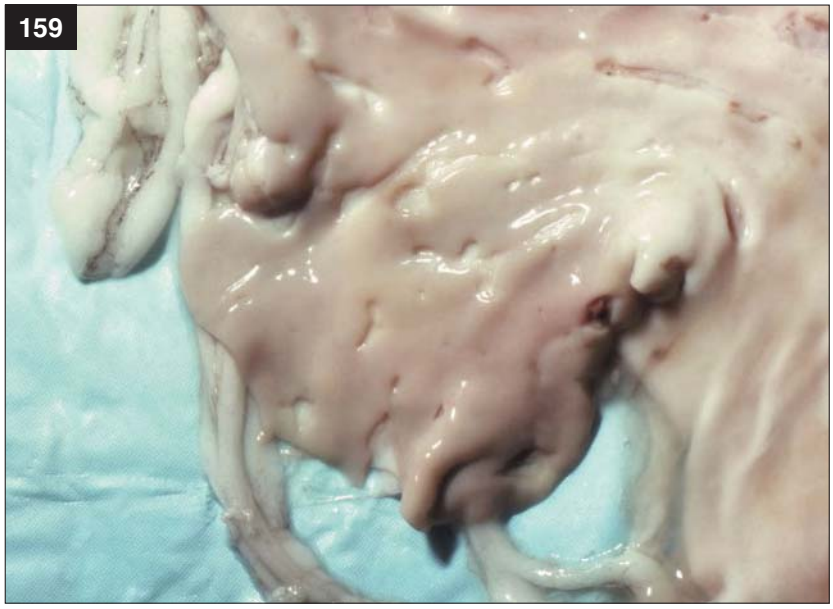

156a


156b



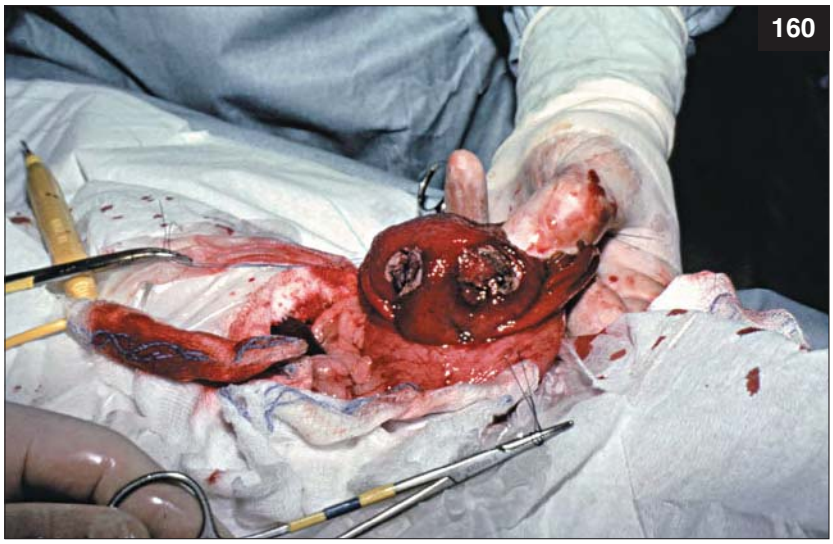
157a, b Gastric ulcers.
These endoscopic views show active diffuse gastric bleeding caused by nonsteroidal antiinflammatory drug (NSAID)-induced ulcers. Visualization of the gastric mucosal erosions can be impaired until the bleeding lessens.

158 Gastric ulcers.
This is a gastroscopic view of NSAID-induced gastric ulcers. The numerous erosions are typical for this particular etiology. They can be a cause of severe blood loss, which is amenable to proton pump blocking drugs. Blood products are indicated for patients suffering from substantial blood loss.

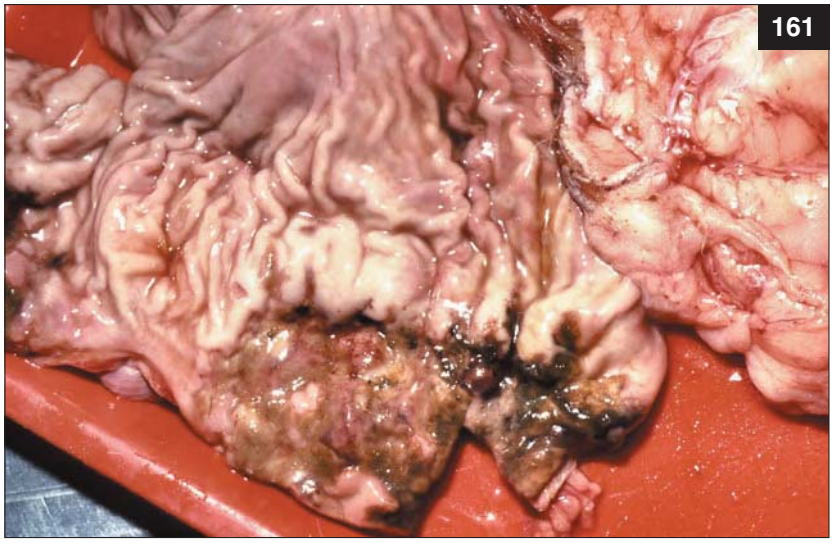


159 Gastric ulcers.
These lesions occurred in a dog that had received only one dose of a human NSAID, which was soon followed by unremitting melena and ultimately exsanguination. The erosions are typical of NSAID-induced gastric pathology. This episode occurred before the development of modern antacid drugs.

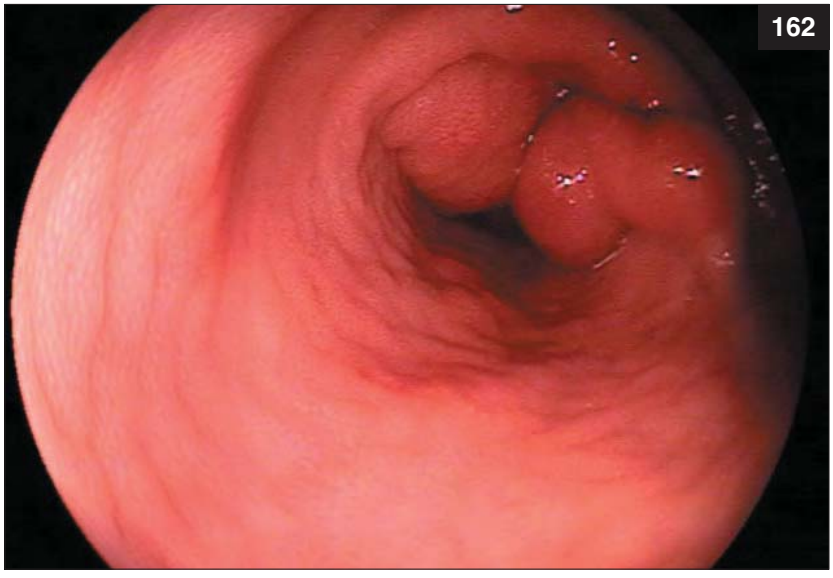
160 Gastric ulcers.
These two large crater ulcers almost perforated the gastric wall. They were caused by irritation from ingested fiberglass insulation material. Ulcers this large and deep require surgical debridement and closure.

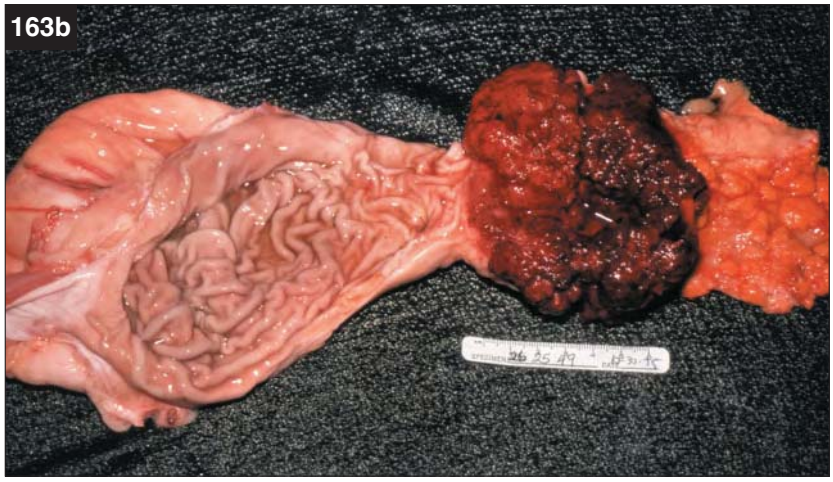


161 Gastric ulcer: glucocorticoid-induced.
This large crater ulcer was most likely due to the large doses of dexamethasone this dog was receiving for its immune thrombocytopenia. The dog's clinical signs included anterior abdominal pain, retching, and melena.



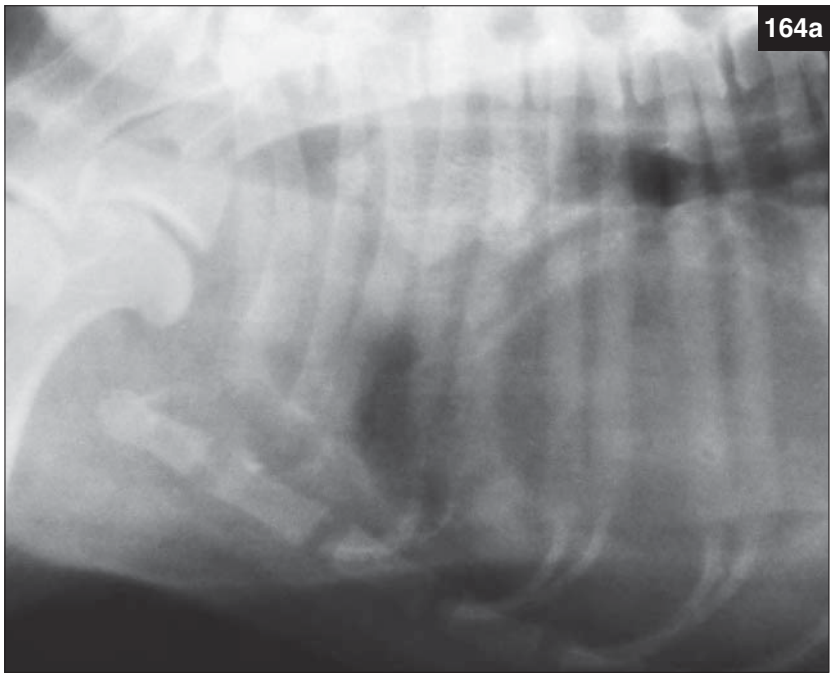
162 Gastric antral mucosal hyperplasia.
A gastroscopic view of this condition is shown. It can cause pyloric outflow obstruction and require surgical resection. Chronic vomiting of gastric juices often causes a metabolic alkalosis and hypokalemia.

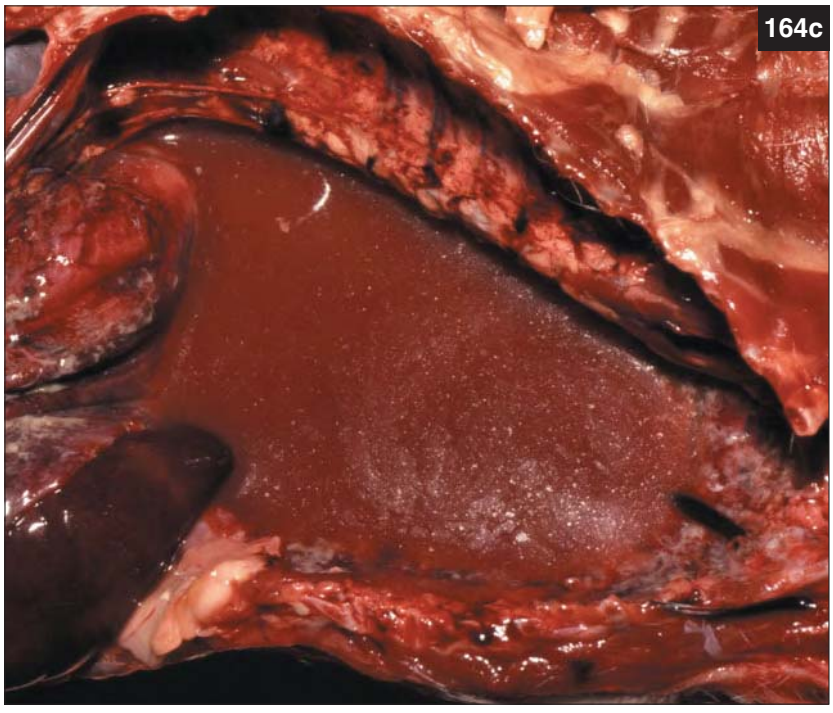




163a–c Proximal duodenal carcinoma.
This dog's melena was caused by a proximal duodenal adenocarcinoma that predisposed the dog to DIC at its terminal stage. Endoscopy and biopsy or abdominal ultrasonography with fine needle aspiration might allow for an antemortem noninvasive diagnosis.

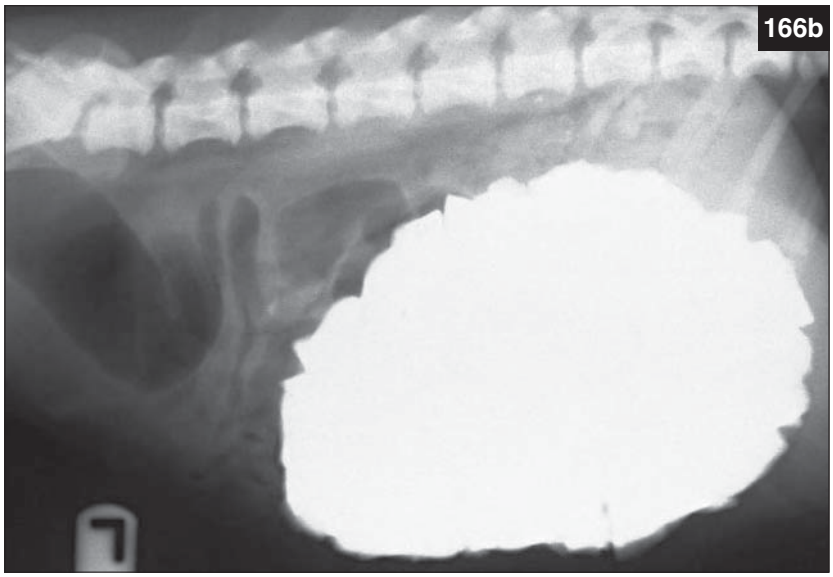
164a–c Esophageal foreign body.
This lateral thoracic radiograph (**164a**) shows a distorted cardiac outline, a pleural effusion, and a mineral-dense esophageal foreign body. This was caused by an ingested bone fragment that had perforated the esophagus (**164b**), causing a septic pleuritis (**164c**) and the dog's demise.





165a, b Inguinal hernia containing intestine. This kitten had been outdoors and returned with a swelling in the proximal medial left thigh. Palpation should indicate the bowel outline, therefore contraindicating any form of needle aspiration of the swelling. The owner of this kitten declined surgery and opted for euthanasia – thus the illustration in **165b**.

166a–d Gastric foreign body. These abdominal radiographs from a young German Shepherd Dog show complete gastric impaction from stones that it had ingested (**166a, b**). Image **166c** shows the actual specimens following their surgical removal. The total weight of the stones was approximately 2.5 kg (**166d**). The mineral density and the sharp edges and contour of the foreign bodies are compatible with stones.

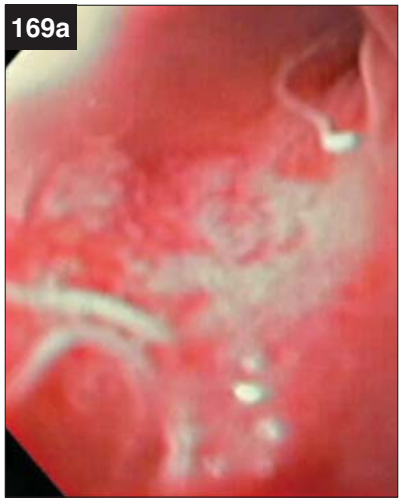

166b


166c


166d

167 Gastroenteritis with mucosal slough.
Shown is a sample of sloughed small bowel mucosa that accompanied a severe bout of gastroenteritis in a Poodle. Enterotoxemia and possibly sepsis are expected complications as a result of the breakdown of the mucosal defense mechanism. Such patients usually require intensive care for as long as 7 days because of accompanying multiple organ dysfunction.

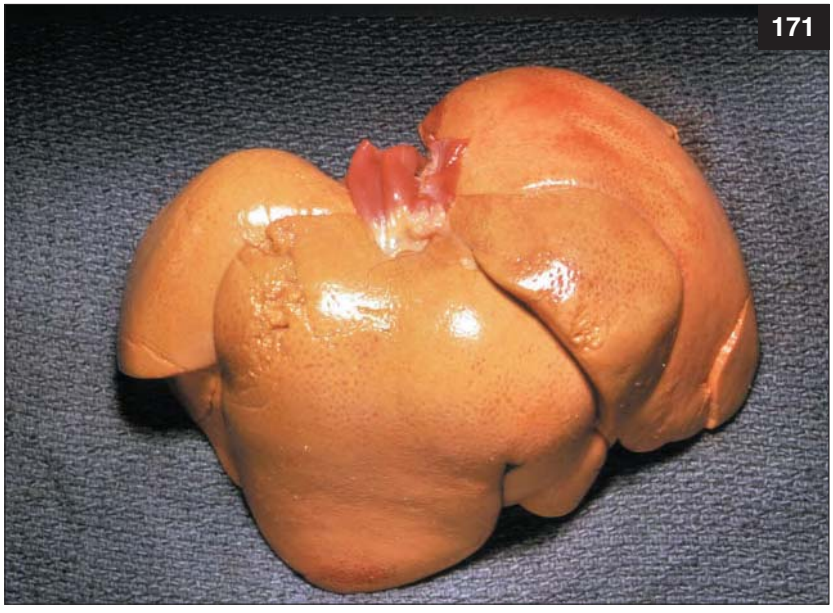
168 Glossitis.
Necrotic glossitis involving most of this cat's tongue was a reason for a very guarded prognosis. There are various causes of this condition including caustic substances, viral disease, vascular compromise through infarction or vasculitis, and metabolic disorders (uremia). Glossitis can be accompanied by stomatitis.



169a, b Hookworms.
Hookworms, roundworms, tapeworms, and the canine stomach worm (***Ollulanus tricuspis***) are upper gastrointestinal parasites that can be visualized by gastroscopy. Hookworms (***Ancylostoma*** species) are visualized on these gastroscopic views.

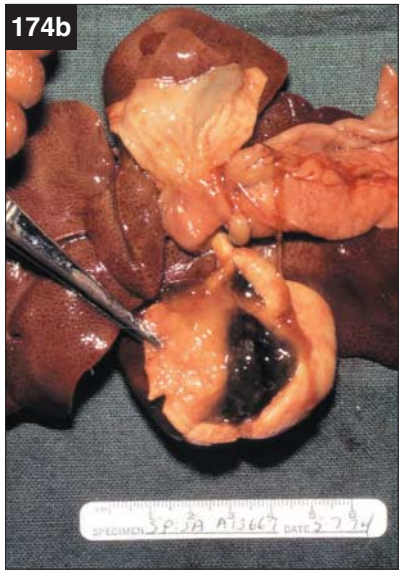
170a, b Hemorrhagic gastroenteritis.
This is a gastrointestinal emergency associated with a peracute loss of blood and plasma. The dog's PCV is usually elevated because of the greater loss of plasma over red blood cells and, perhaps, splenic contraction causing release of red blood cells into the circulation.

171 Hepatic lipidosis.
Primary hepatic lipidosis in the cat can cause death from liver failure in approximately 50% of cases, especially when it is severe, as shown in this image. Minimal digital pressure caused the friability seen on the surface. The secondary form that occurs in diabetic animals is temporary and resolves when the diabetes is under control.



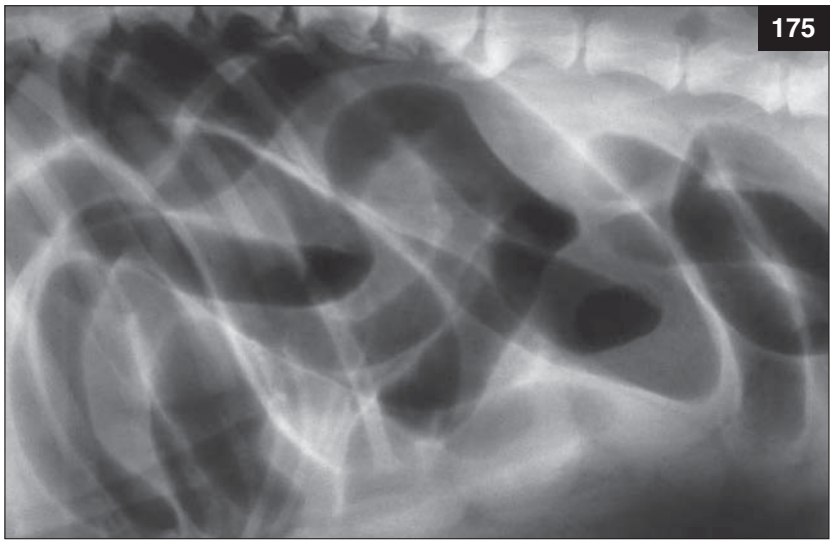
172 Icterus.
Jaundiced mucous membranes appear orange when the red blood cell count is near normal, as shown in this dog. The combined red hue from hemoglobin and the yellow from the icterus produce the orange color.

173 Icterus.
This dog's oral mucous membranes are very yellow instead of orange because of its severe hemolytic anemia (PCV 0.1 l/l [10%]), which deprives the tissues of the red oxygenated hemoglobin color. It is the combination of red (from red blood cells) and yellow (from jaundice) that produces the orange colored mucous membranes. Appreciating this can allow the clinician to plan to provide the patient with transfused red blood cells.

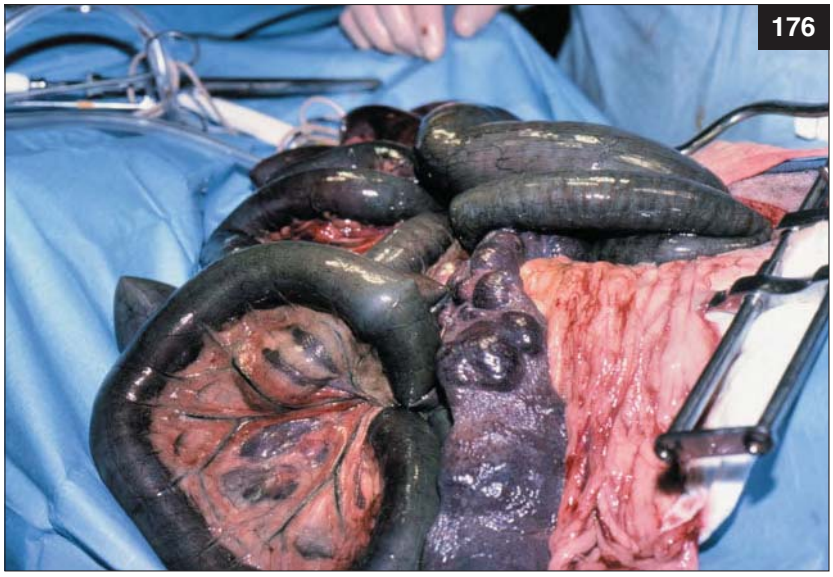


174a, b Icteric cat.
The intense icterus in this cat was caused by suppurative cholangiohepatitis with biliary outflow obstruction (**174a**). The postmortem findings included suppurative cholangiohepatitis, cholecystitis, and bile duct obstruction caused by inspissated bile (**174b**).

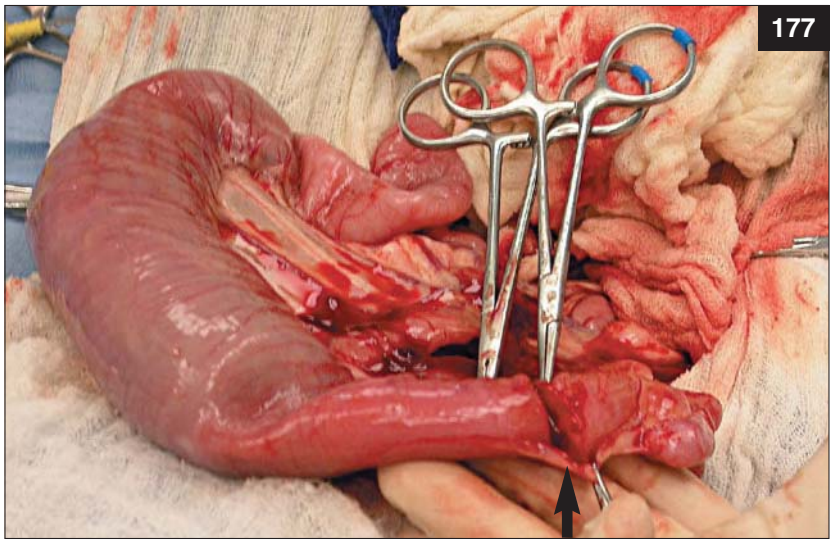
175 Intestinal volvulus: radiograph.
This lateral radiograph is from a dog that had septic shock caused by an intestinal volvulus. The diffuse gas-distended bowel represents the gangrenous bowel loops, as depicted in **176**. This should be regarded as a surgical emergency after the patient is first stabilized with IV fluids, antibiotics, and vasopressors, if necessary.



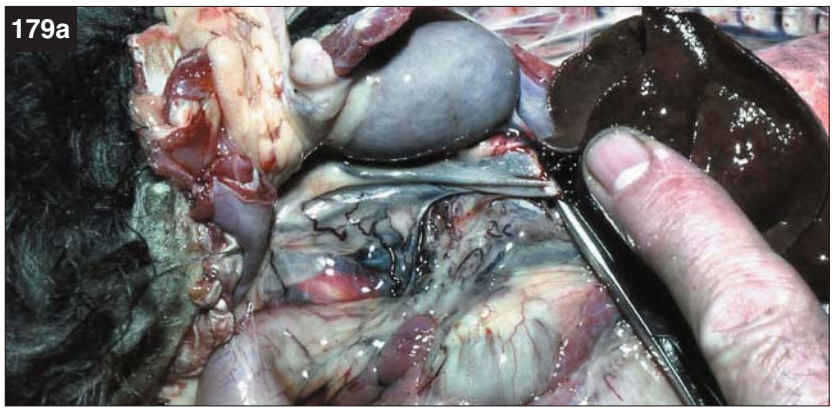
176 Intestinal volvulus: surgery.
Exploratory laporotomy of the dog in case **175** revealed that the volvulus involved both the colon and the small intestine. The green-black color represents gangrene. The dog was euthanized.

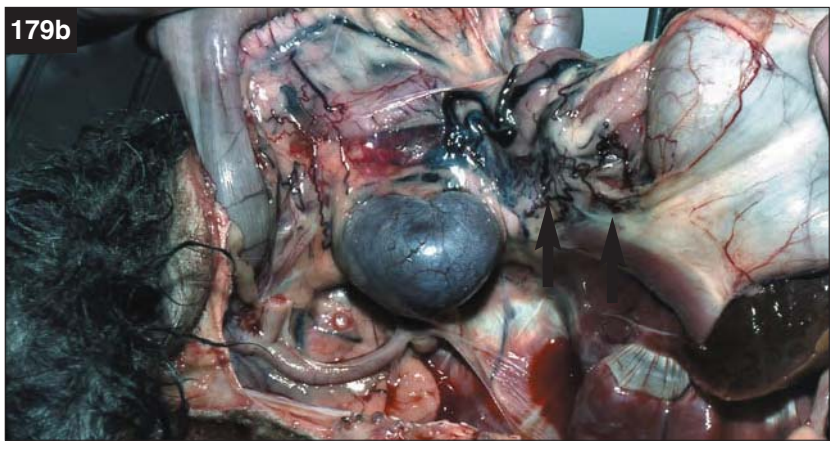


177 Ileal muscular hypertrophy in a cat.
The hypertrophy of this cat's ileal wall caused an obstruction requiring surgical resection. The cause is unknown and the onset is insidious.



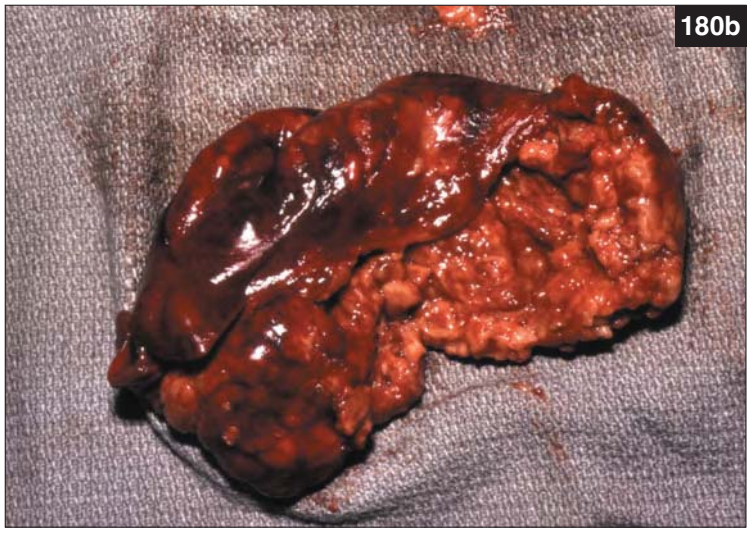
178 Liver: macronodular cirrhosis.
Cirrhosis is associated with chronic signs of liver failure, with clinical signs that might only consist of anorexia and weight loss. Cocker Spaniels are predisposed to this disorder, which eventually will cause the patient's demise. The macronodular form is shown.

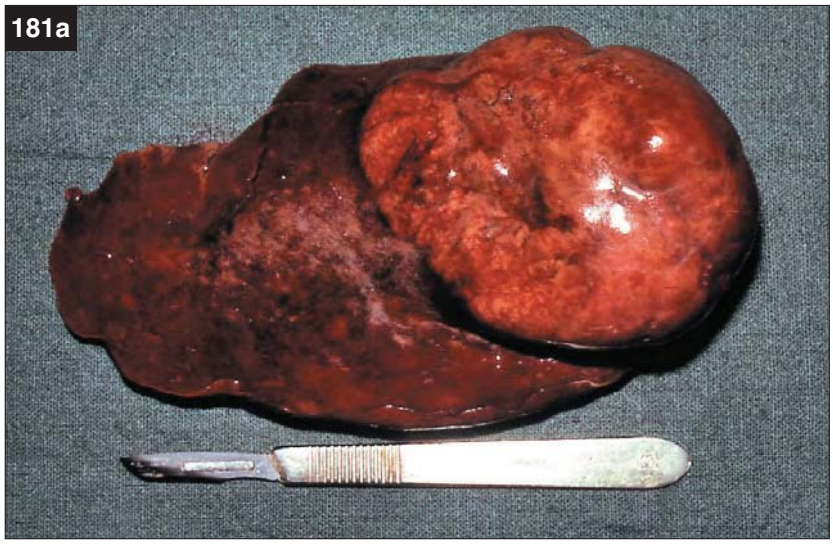




179a–c Liver: micronodular cirrhosis and varices.
These postmortem findings are from a dog that died from progressive liver failure. It had micronodular cirrhosis and portal hypertension that caused the formation of numerous shunt vessels (varices - arrows in **179b**), including the one joining the azygos vein (arrow in **179c**).

180a–c Liver abscess.
Liver abscessation can be fatal if it is not diagnosed and treated early. This dog's right liver lobe had become one large abscess. Gram-negative bacteria are the usual infecting organisms. It is important to operate before it ruptures in order to avoid sepsis and devastating consequences.

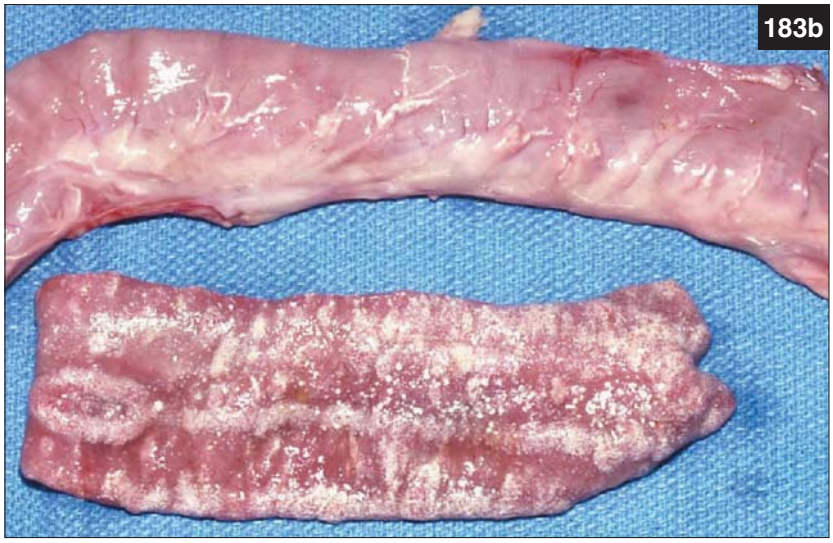




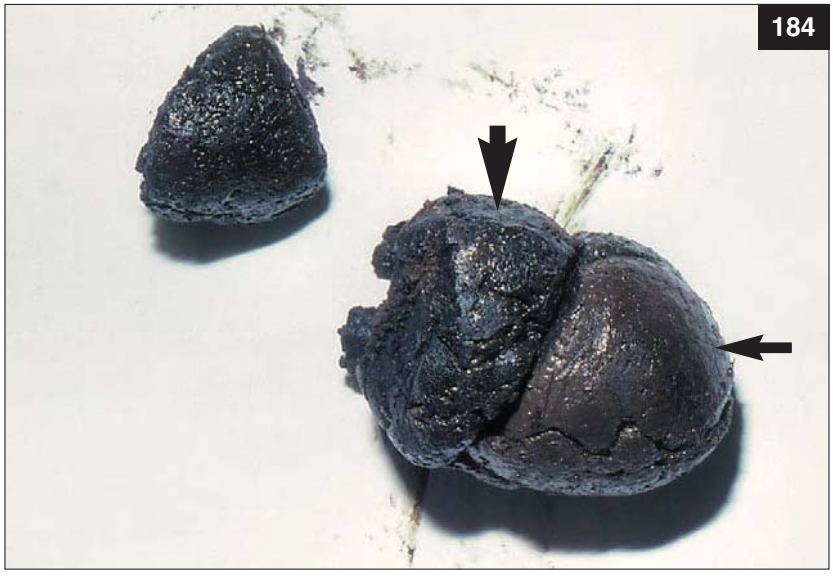
181a, b Liver abscess. This specimen belonged to a diabetic Poodle that went to surgery for resection. The liver abscess has a distinct border. Abdominal ultrasonography will help identify the liver mass as an abscess by the characteristic presence of gas within the liver parenchyma.

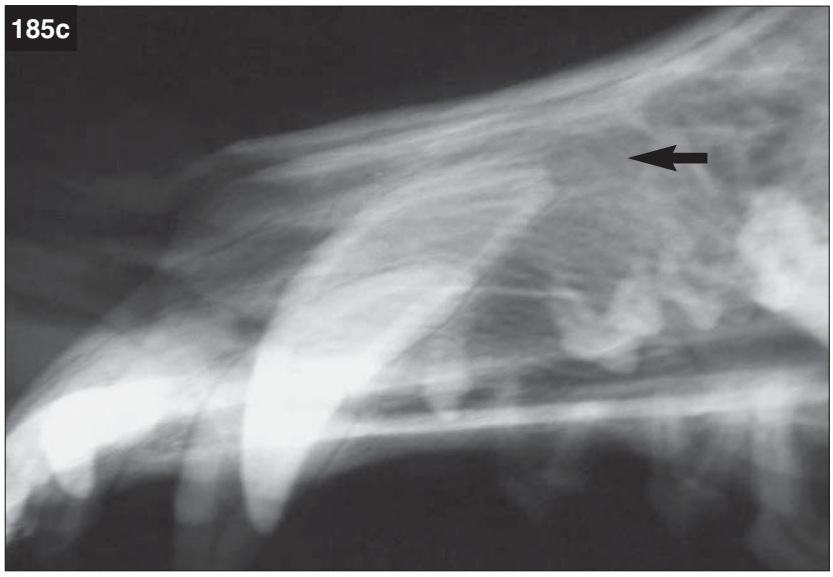
182 Feculent vomitus. Brown colored malodorous vomitus commonly occurs from distal bowel obstruction, ranging from the distal jejunum to the colon. Most patients with this type of vomitus have an underlying surgical disease somewhere between the distal jejunum and the colon.

183a, b Lymphangiectasia. This small bowel specimen is from a young Rottweiler that had panhypoproteinemia caused by congenital lymphangiectasia. The abnormal lymphatic vessels are shown as white linear vessels on the serosa and numerous small white projections on the mucosa.



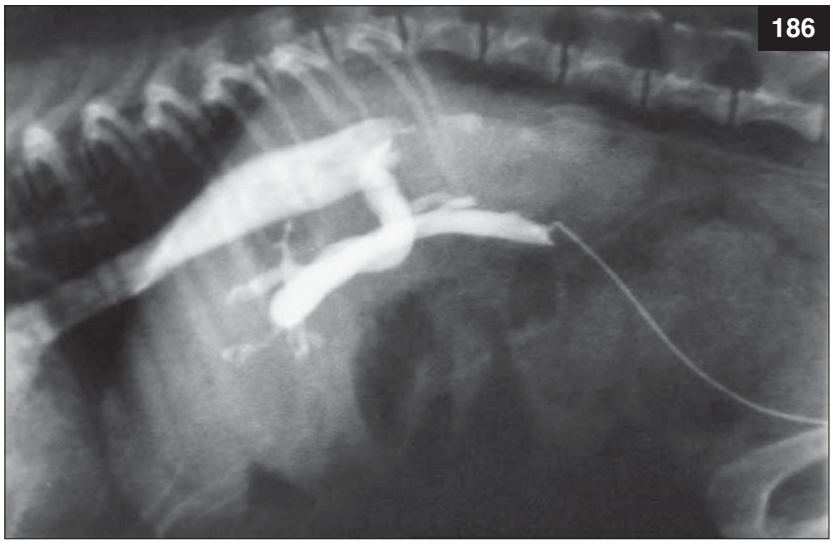
184 Melena. This fecal sample shows dark brown pigment at the posterior end (arrow) and black pigment more anteriorly (fat arrow). It came from a dog that had NSAID-induced gastric hemorrhages and had not defecated for approximately 2–3 days prior to examination. The typical melena could have been overlooked if only the most caudal specimen was taken.





185a–c Periapical abscess. Note the parulis, which is the gingival swelling and inflammation just caudal to this Greyhound's canine tooth (**185a** - arrow). A periapical abscess in this tooth was the cause of the dog's pain and refusal to eat. Treatment entailed tooth extraction. Also shown is the extracted tooth (**185b**) and a radiograph showing the periapical lucency resulting from the abscess (**185c**).

186 Portacaval anomaly. A jejunal venous angiogram was done surgically to demonstrate the large extravascular congenital shunt vessel that is shunting blood from the portal vein into the posterior vena cava. Portacaval venous anomalies can be either extrahepatic (usually in small breed dogs) or intrahepatic (usually in large breed dogs).



187 Small bowel infarction. This small bowel infarction (also shown in the hematology section, case **133**, p. 111) occurred as a result of the prothrombotic effects of large doses of glucocorticoids that were being used to treat the dog's immune hemolytic anemia. Perforation and sepsis will occur if the infarcted segment is not removed in a timely manner (first few hours).

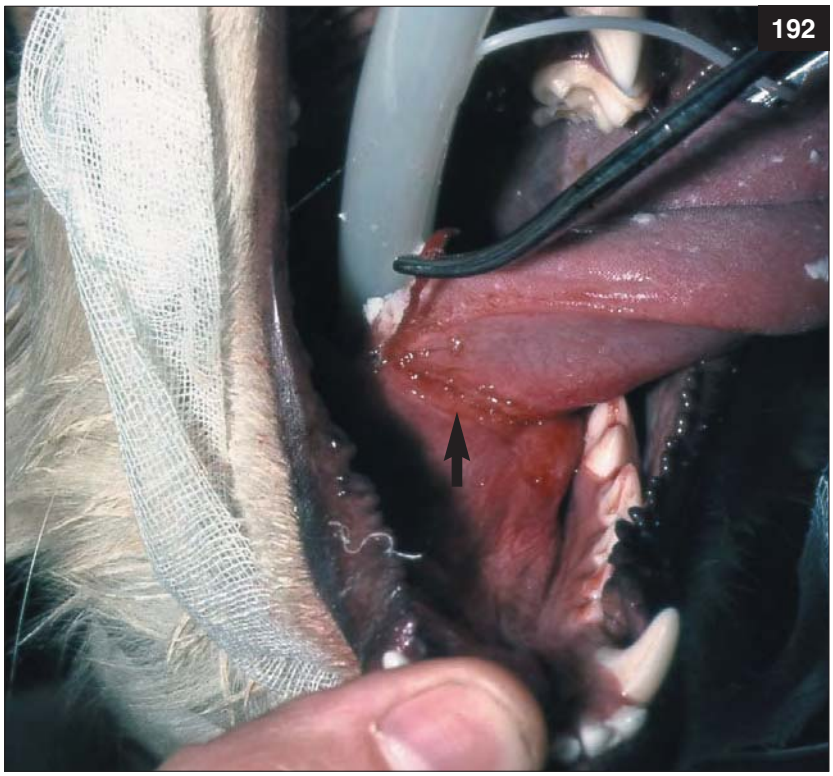
188 Small bowel infarction. This postmortem lesion was caused by an arterial embolus associated with sepsis and DIC. Note that the infarcted area reflects the blood distribution of the involved vessel.

189 Rannula in a cat.
Sublingual salivary cysts are not as common in the cat as they are in the dog. This image shows a rannula in a cat.

190a, b Small bowel linear foreign body obstruction.
A careful examination under this cat's tongue discovered a black sewing thread sublingually (arrow). If the cat was vomiting, as it was in this case, surgery would be needed because vomiting is a sign of obstruction. If the cat was acting normally (eating and defecating) after the ingestion of the linear foreign body, there could be a chance for it to passage successfully through the bowel.

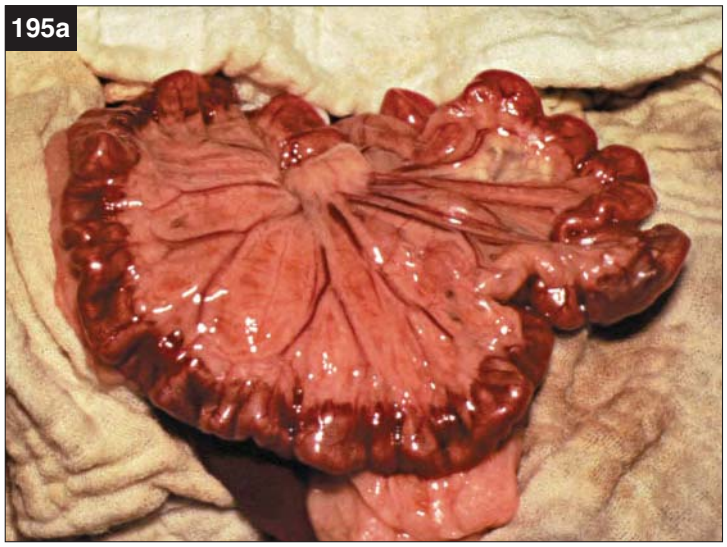
191 Small bowel linear foreign body obstruction.
An oral examination of this anesthetized dog, admitted for vomiting because of gastrointestinal obstruction, shows panty hose anchored under the tongue. The remaining segment was causing a small bowel obstruction.

192 Small bowel linear foreign body: sublingual ulceration.
Oral examination of this dog shows a sublingual erosion associated with a string that had caused a circumlinear ulceration (arrow). Such lesions should immediately prompt a detailed examination of the sublingual area.



193 Small bowel linear foreign body.
A piece of string managed to reach the rectum of this dog, but the anterior segment was simultaneously causing a small bowel obstruction. The dog was vomiting and anorexic, which are hallmark signs of a linear foreign body small intestinal obstruction and the indication for its surgical removal.

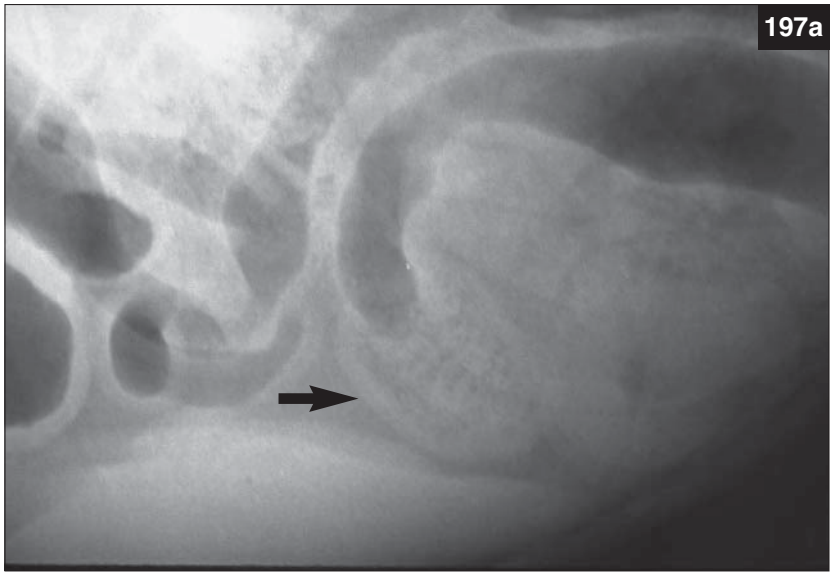
194 Small bowel linear foreign body obstruction. In this dog a several day delay in diagnosis resulted in the panty hose foreign body causing several bowel perforations. This led to septic shock and the dog's demise.

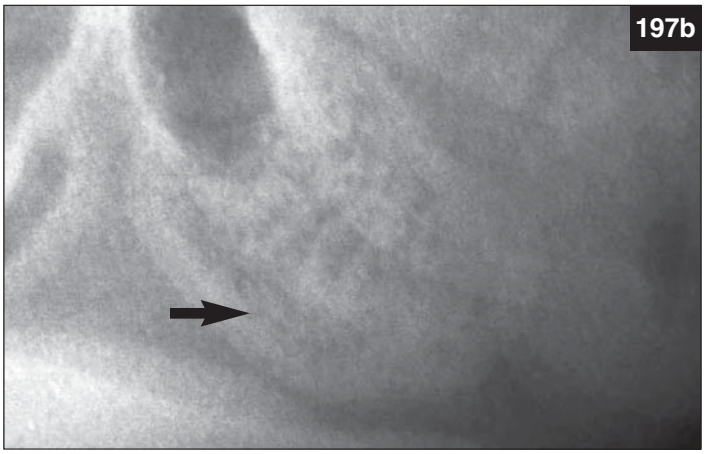


195a, b Small bowel linear foreign body obstruction. This small bowel shows the classic pleating caused by a linear foreign body obstruction in a cat (**195a**). This abnormality can be detected with abdominal palpation and on a plain radiograph (to the trained eye), where it appears as a gathering of the small bowel loops, with asymmetrical segmental dilatation (**195b**). Perforations are routinely found on the mesenteric border (arrow in **194**).

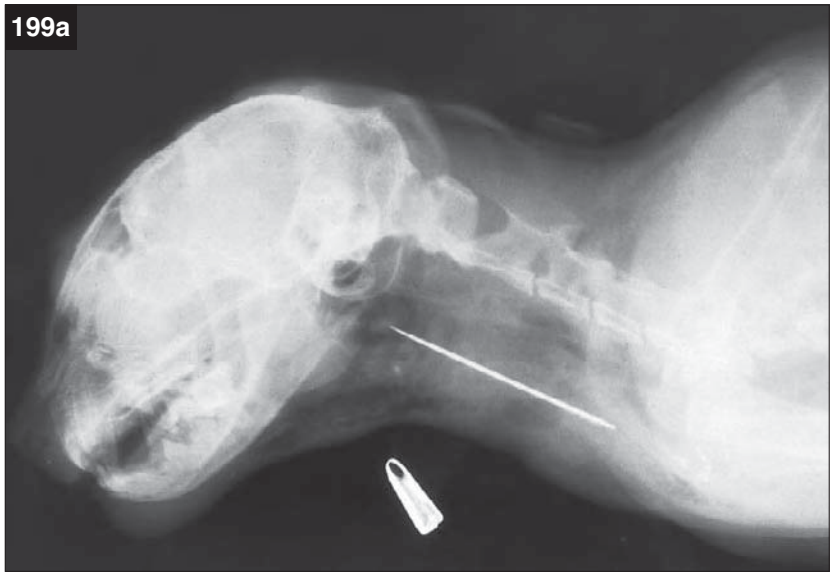
196 Small bowel linear foreign body.
Note the sublingual sewing thread foreign body and the circumlinear sublingual ulcerations. The remainder of this ingested linear foreign body was causing small intestinal obstruction that had resulted in anorexia, vomiting, and dehydration prior to surgical correction.

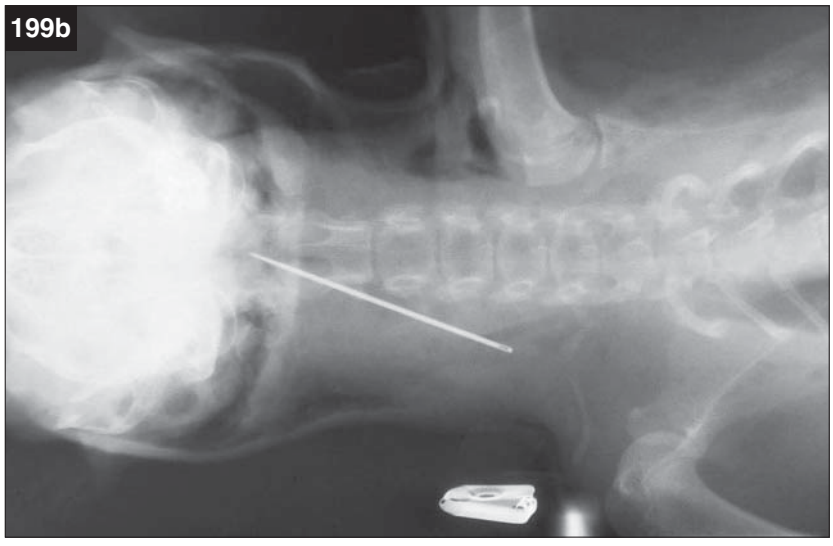
197a, b Small bowel obstruction: corn cob-induced.
These close-up abdominal radiographs show a gas pattern indicative of a small bowel obstruction. They also indicate the cause, as shown by the air cells in the corn cob (arrow). The abnormally distended loops of small intestine indicate obstruction, and this is the main indication for surgery. Some intestinal foreign bodies will pass harmlessly through the bowel in the asymptomatic patient; however, any vomiting and anorexia will make surgery imminent.





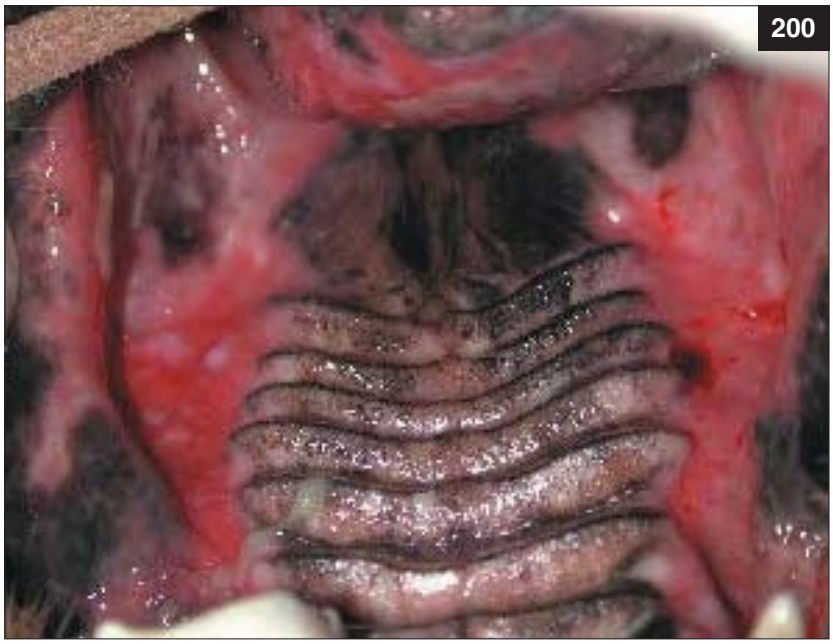
198 Oral foreign body: sewing needle.
Cats that ingest a sewing needle can have it lodge in their hard palate (arrow). Removal should be done while the cat is under general anesthesia because any panic reaction during its removal can be a calamity. The sharp pointed end is usually pointed anteriorly.





199a, b Migrating foreign body: sewing needle.
A sewing needle can penetrate the frenulum and migrate in the cervical soft tissues to cause severe cellulitis. Removal is not as easy as it appears on the radiograph because the depth of the foreign body cannot be assessed accurately radiographically.

200 Stomatitis.
Inflammation of the oral mucous membranes can occur as a result of dental disease, caustic substances, infectious diseases, and immune-mediated diseases. The exact diagnosis usually requires biopsy and special testing if obvious causes are ruled out with the history and physical examination.

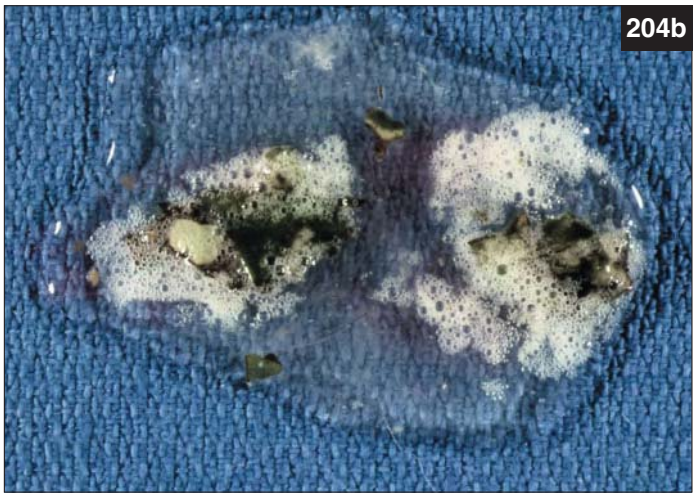


201 Severe ulcerative stomatitis.
The palate lesions in this cat were first tentatively diagnosed as eosinophilic granuloma complex, but they continued to erode and caused complete penetrating lesions through the palatine bones. Biopsies identified the lesions only as stomatitis of unknown origin.

202 Stomatitis.
Severe stomatitis, as seen in this Cocker Spaniel, might be causally related to dental microflora and be refractory to treatment with antibiotics and glucocorticoids until the decision is made to extract all of its teeth. Extracting normal teeth is a very lengthy procedure that can take as long as 2 hours.

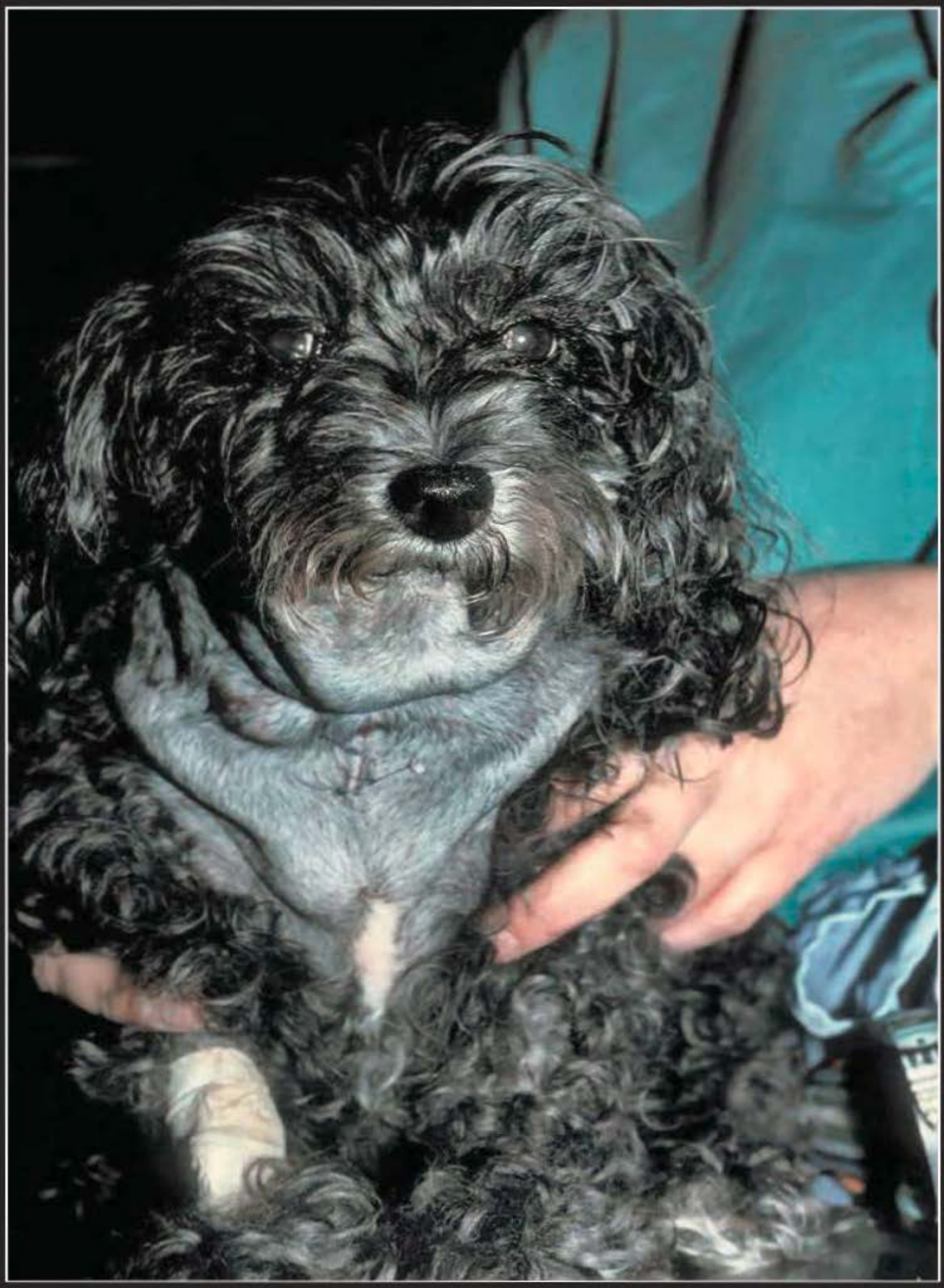
203a, b Trichobezar.
These hair accumulations can become of pathologic significance more commonly in the cat. The ones in **203a** caused gastric outflow obstruction, while the one in **203b** caused esophageal obstruction.

204a–d Vomiting dog.
The presence of bile in this dog's vomitus indicates that the pylorus is patent (**204a**). The diagnosis was acute pancreatitis. Gastric type vomitus is either clear mucoid (**204b**) or it might show signs of gastric hemorrhage by containing fresh red blood (**204c**) or older hemolysed blood resembling 'coffee-grounds' (**204d**).


204b


204c


204d



8

Endocrine disorders

ENDOCRINOLOGY is derived from the Greek word ***endon***, meaning within, and ***krin***, meaning to separate. Disorders of this medical discipline include several interesting syndromes, a number of which involve metabolism, including fluid and electrolyte disorders. Endocrinopathies can involve different organ systems throughout the body, thereby requiring the clinician to have a broad knowledge base in order to fully understand the pathophysiology, which might be very complex. Routine diagnostic tests are used to assess a patient with an endocrine disorder, but special tests are required in order to fully evaluate the endocrine disorders.

The images in this section illustrate the highlights of several endocrinopathies and should prove useful to the practicing clinician.

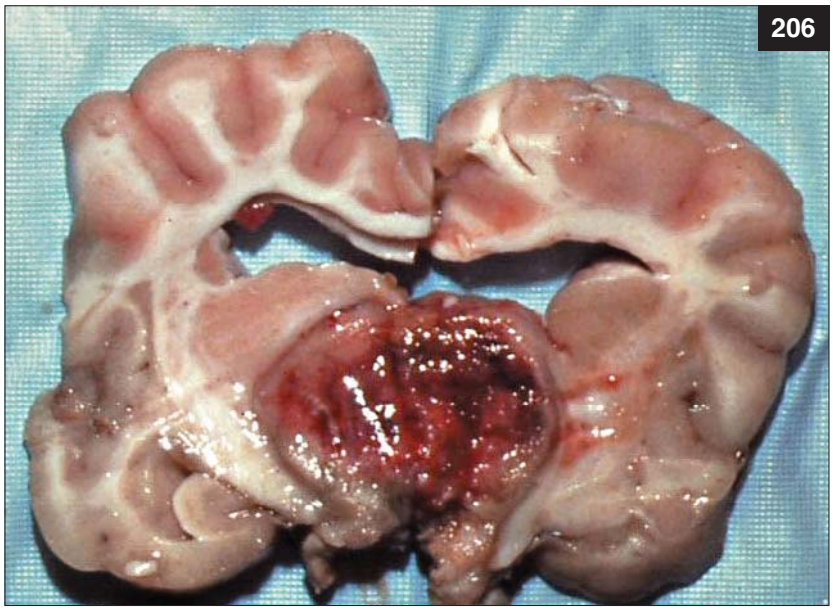
◀ An acromegalic Poodle

Endocrine disorders

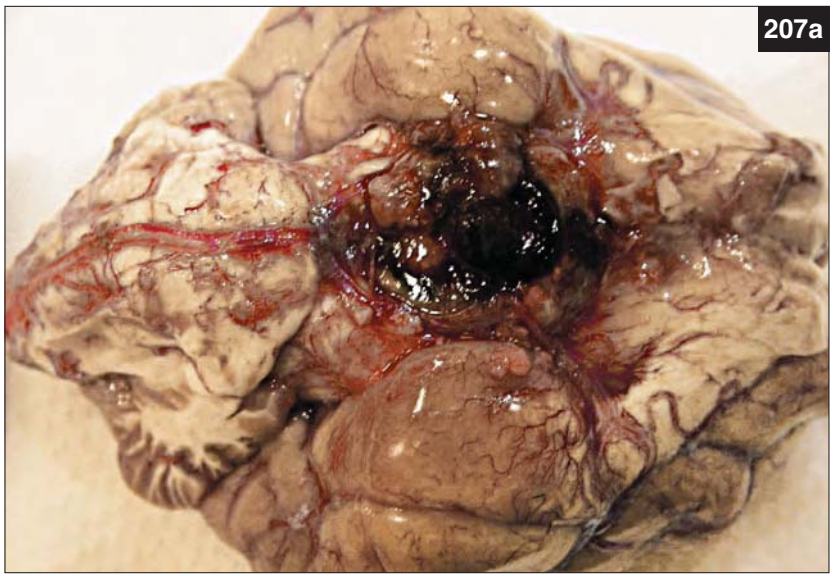
- Hypercholesterolemia plus elevated CK – rule out hypothyroidism.
- U-100 syringe (or TB) must be used for U-100 insulin.
- Do not forget K+ when treating DKA.
- Oliguric untreated diabetics have marked hyperglycemia.
- Glycosuria can occur with diabetes, proximal renal tubular disease, stress, IV dextrose.
- Marked hyperglycemia with minimal glycosuria – consider oliguria/anuria.
- Morning marked glycosuria and afternoon diminished glycosuria – typifies transient insulin response (need split dose).
- Can use soiled litter to detect glycosuria.
- Hyperglycemia can sometimes be detected in tears.
- Assess the eclampsia dog for hypoglycemia.
- Try mannitol for severe hypoglycemic encephalopathy.
- When Florinef does not work well, use DOCP and prednisone.
- The hypocalcemic cat has not read the book.
- Keep an eye out for the atypical Addisonian.

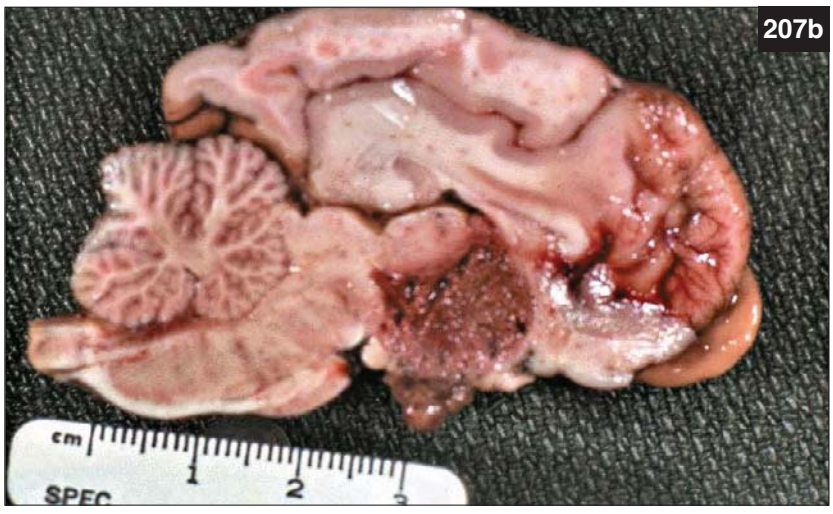
205 Hyperadrenocorticism (Cushing's).
This dog shows many of the classic physical signs of Cushing's syndrome including generalized alopecia with hyperpigmentation, easy bruising, and a pendulous abdomen. The alopecia is present in approximately 70% of all dogs with endogenous hyperadrenocorticism. Hair regrowth might require as long as 12 or more months and it usually returns darker.

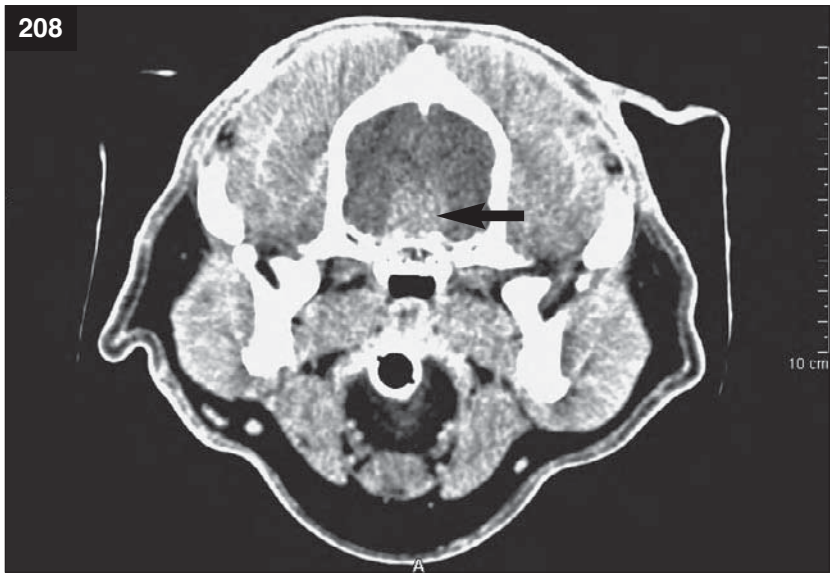
206 Hyperadrenocorticism macroadenoma.
Shown is a postmortem coronal cut section of a Cushing's dog that had a functional pituitary macroadenoma. The acute hemorrhage is known as pituitary apoplexy (or stroke), which can cause acute clinical signs consisting of mental depression, circling, and progressive neurologic deterioration to a comatose state as a result of tumor necrosis and hemorrhage deep into the diencephalon.



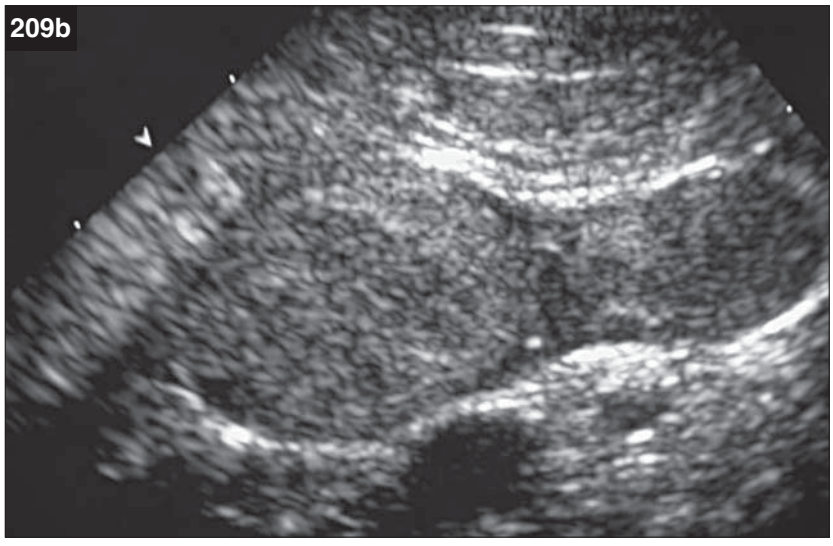
207a, b Hyperadrenocorticism macroadenoma.
These ventral (**207a**) and sagittal (**207b**) views, from different dogs, show the tumor invading and hemorrhaging into the diencephalon. The degree of internal involvement can not be appreciated at necropsy without cutting into the brain parenchyma. Clinically, such dogs have marked levels of depressed consciousness.







208 Hyperadrenocorticism: CT scan.
Pituitary tumors can be easily detected with today's modern imaging modalities. Contrast media can be used to highlight a pituitary tumor. Shown is a macroadenoma growing deep into the hypothalamus (arrow).



209a, b Hyperadrenocorticism.
A postmortem specimen of bilateral adrenocortical adenomatous hyperplasia is shown (**209a**). This is sometimes mistaken for adrenal malignancy on ultrasonography (**209b**). The differential diagnoses for this sonogram would be adrenocortical nodular hyperplasia, adrenocortical adenoma, adrenocortical adenocarcinoma, and pheochromocytoma. Depressed serum cortisol blood levels on the post dexamethasone suppression test would be strongly suggestive of benign disease.

210a–e Hyperadrenocorticism. A 10-year-old cat with hyperadrenocorticism caused by exogenous repositol glucocorticoid treatment is shown (**210a**). Note the folded ear tips (**210b**) and the characteristic skin tears (**210c**) caused by altered collagen structure and epidermal fragility, respectively. Many cats with hyperadrenocorticism have coexisting diabetes mellitus. The same cat is shown 4 years later after the steroids were withdrawn (**210d**). Also shown (**210e**) is a skin tear following a simple jugular venipuncture, illustrating the increased skin friability in the Cushing's cat.

211 Hyperadrenocorticism: calcinosis cutis. Calcinosis cutis is a classic sign of glucocorticoid excess. Shown is a typical inflammatory form of this disorder. This lesion will eventually resolve after the serum cortisol levels return to near normal levels.

212 Hyperadrenocorticism: calcinosis cutis.
This is an example of the dry form of calcinosis cutis appearing as dry plaque-like lesions. The lesions might vary in size from several millimeters to many centimeters in diameter. Also shown is epidermal atrophy, appearing as wrinkles.

213a–c Hyperadrenocorticsm: calcinosis cutis.
The inappropriate use of glucocorticoid drugs caused both the dry and inflammatory forms of calcinosis cutis in this Mastiff. The problem resolved after months of hydrotherapy.

214 Hyperadrenocorticism: calcinosis cutis.
The inflammatory form of calcinosis cutis is shown in two commonly involved areas, the inguinal and axillary regions. Not all dogs with hypercortisolism have this skin disorder. It can cause discomfort because of its location in regard to limb movement. Drying alum-containing topical medications are useful in treating this disorder.

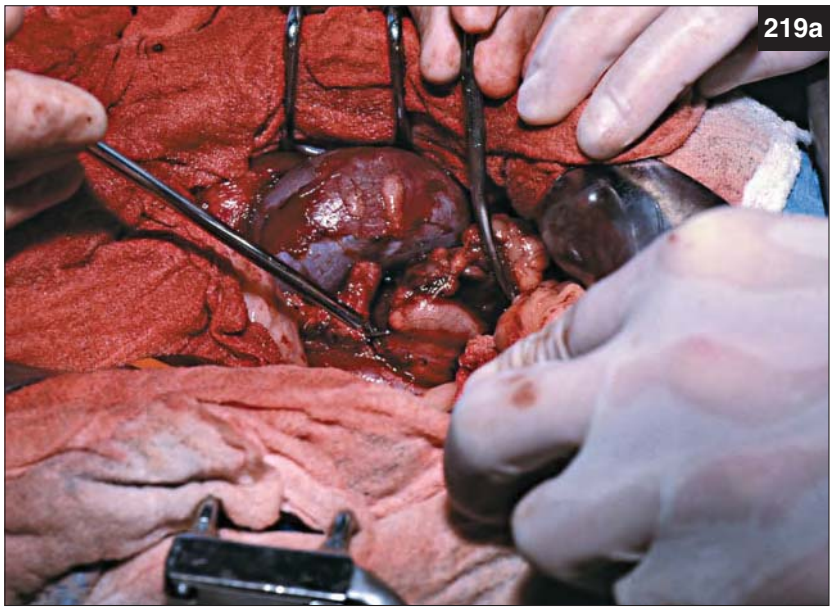
215 Hyperadrenocorticism: calcinosis cutis.
Shown is a close–up view of inflammatory calcinosis cutis. Note the typical yellow colored areas of mineralization. The dry form of this condition can occur around the periphery of the inflamed areas.

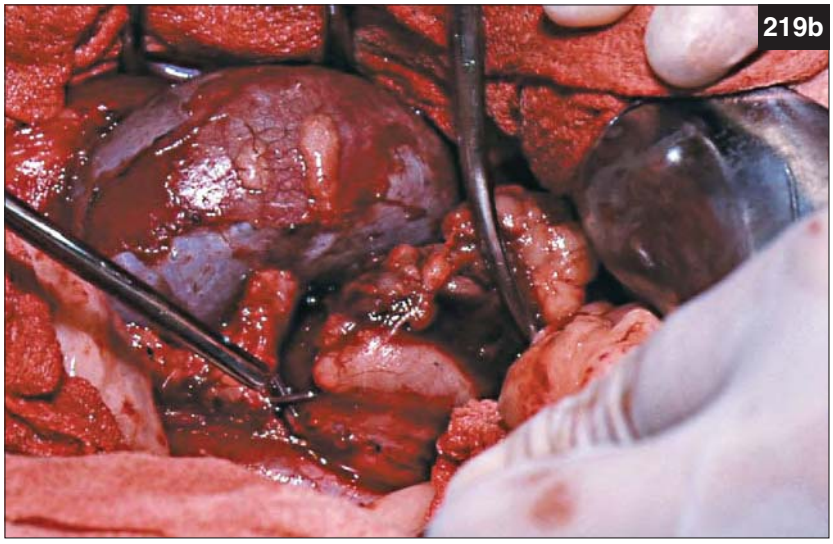
216a–c Hyperadrenocorticism: calcinosis cutis.
Calcinosis cutis can have various shapes and degrees of involvement. The lesion depicted on this Dachshund's abdomen was extensive, but it did resolve after the hypercortisolism was resolved. Before (**216a, b**) and after (**216c**) images are shown.

217 Hyperadrenocorticism-associated tissue infarct.
This Dachshund's hyperadrenocorticism condition caused it to have a prothrombotic tendency, which caused this lingual infarction and tongue necrosis. Most dogs cannot prehend food when they lose half their tongue.

218a, b Hyperadrenocorticism: myoneuropathy.
Even though the Cushing's signs in this German Shepherd Dog showed a good response to mitotane, the myopathy and neuropathy lesions persisted. Note the atrophied thigh muscles and the hyperextended hindlimb posture. The dog's limb movement was significantly impaired.

219a, b
Hyperadrenocorticism: periadrenal tumor hemorrhage.
Adrenocortical carcinomas can sometimes undergo spontaneous retroperitoneal hemorrhage, as shown in these surgical views. Note how the peritoneum bulges into the abdominal cavity. When this episode occurred the night before surgery, the dog showed acute signs of weakness and hypovolemia and had to be resuscitated with intravenous fluid treatment.

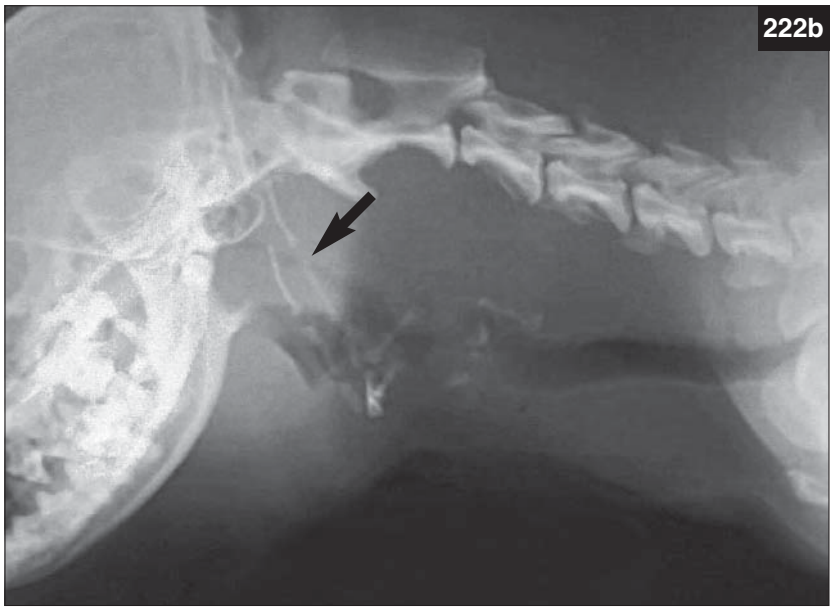




220 Hyperadrenocorticism: stria.
The stretch marks seen near the umbilicus in this dog are more common in humans than in cushingoid dogs. The stretching occurs because of the abdominal distension associated with weakened abdominal muscles.

221a, b Acromegaly.
The dentition in this adult female Irish Setter shows the gingival hyperplasia and wide interdental spaces typical of acromegaly in the dog. This dog was in diestrus and had coexisting diabetes mellitus associated with insulin resistance caused by the excess growth hormone secretion. Acromegaly will resolve once the hyperprogestagen secretion is terminated. The acromegaly and the diabetes resolved in this dog following ovariohysterectomy.

222a, b Acromegaly.
Medroxyprogesterone acetate injections caused the acromegaly and associated respiratory stridor in this dog (**222a**). This latter problem is caused by the growth hormone-induced pharyngeal hyperplasia. The increased pharyngeal soft tissue can be seen on this dog's lateral radiograph (**222b -** arrow). Artificial airway support is not always necessary. The dog also had a mammary gland carcinoma on her right 3rd gland (arrow), which might have been influenced by the excess growth hormone production. Growth hormone can be an oncogenic stimulus in mammary tissue.



223a, b Acromegaly.
This female Poodle became acromegalic during her estrus cycle (diestrus). Ovario-hysterectomy was eventually performed to resolve the problem. The resulting proliferation of pharyngeal tissue caused airway occlusion requiring a tracheostomy procedure. Note the superfluous cervical skin.

224 Diabetic ketoacidosis.
This dog is in a terminal status because of diabetic ketoacidosis, acute pancreatitis, and anuric renal failure. Note the empty urine collection bottle in a dog that would ordinarily be polyuric. The blood glucose level at the time of the anuria was approximately 55 mmol/l (1,000 mg/dl). This would offer a grave prognosis.

225 Diabetic cat with hypercortisolism.
This cat was made 'cushingoid' iatrogenically with glucocorticoid injections. He also became diabetic and then had diabetic neuropathy, as seen by the plantar posturing. The hypercortisolism signs eventually disappeared as the glucocorticoid levels declined over time. The insulin-requiring diabetic condition also resolved after approximately 2 years.

226a, b Diabetic neuropathy.
This cat shows typical diabetic neuropathy before (**226a**) and after (**226b**) improved regulation with insulin. The plantar posture is characteristic of this disorder in the cat. With improved insulin control, the neuropathy resolved over a period of 4–6 weeks.

227a, b Diabetic neuropathy in the dog.
This disorder in the dog resembles a myelopathy, with signs of proprioception loss and paraparesis that can progress to paraplegia. The Samoyed (**227a**) shows weakness and hindlimb proprioception loss while the Chesapeake Bay Retriever (**227b**) shows quadriparesis. Both dogs returned to normal with adequate insulin treatment and physical therapy.


227a

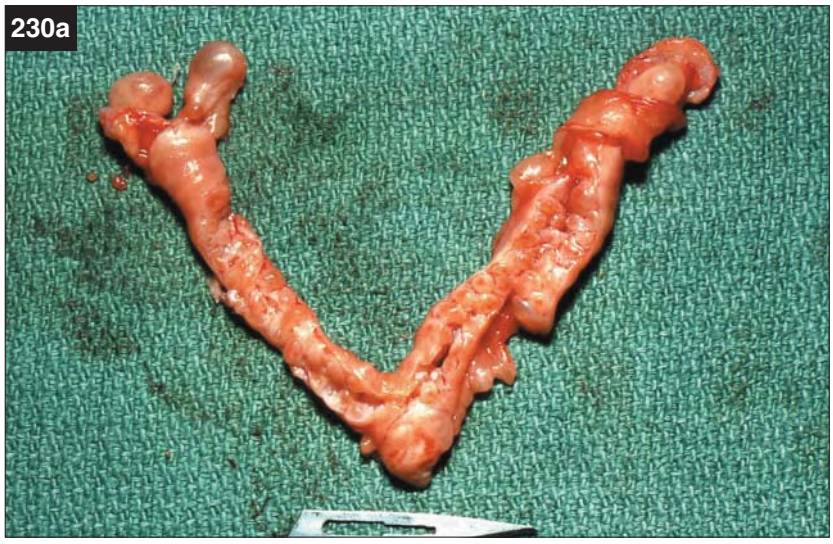

227b

228a, b Diabetic thrombophlebitis in a cat. This cutaneous lesion is a streptococcal ulcerative thrombophlebitis in a newly diagnosed, untreated diabetic cat's right jugular vein. It was associated with a routine venipuncture and caused the cat to go into acute diabetic ketoacidosis. This attests to the untreated diabetic's predisposition to infection, which is due to impaired neutrophil bactericidal ability as well as impaired B- and T-cell immune function.

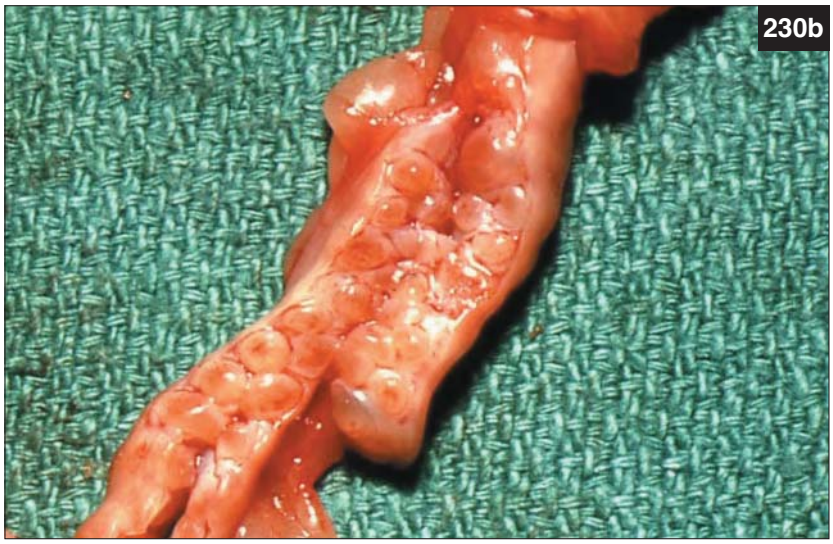

228a


228b

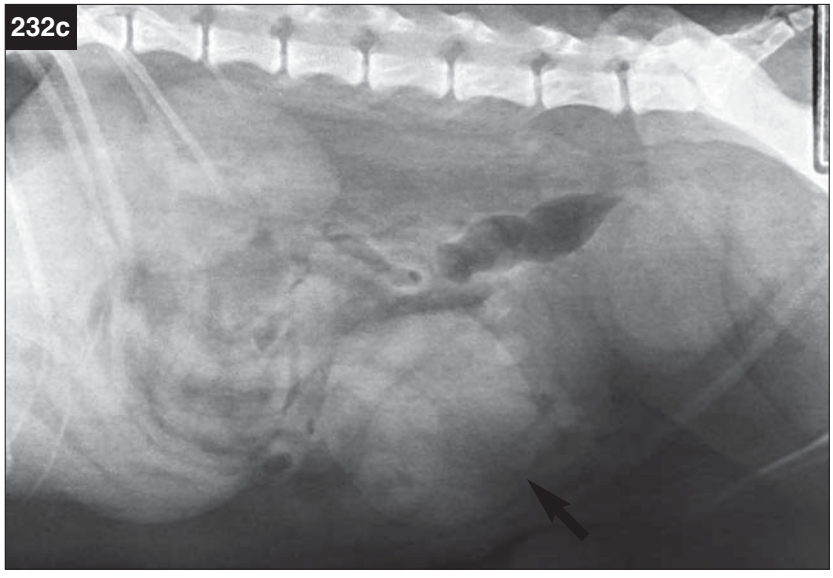
229a, b Hyperestrinism. Abnormally elevated levels of estrogen can be caused by cystic ovaries, ovarian tumors, testicular tumors, or estrogen-containing drugs. Typical signs are illustrated in this Bischon Frise (**229a**). Note the edematous and enlarged vulva, the serosanguineous vulvar discharge, and the pattern of alopecia and skin hyperpigmentation (**229b**). Male dogs were very attracted to this dog.



230a, b Hyperestrinism. The dog in **229** also had cystic endometrial hyperplasia. If vaginal bacteria had ascended into the uterus, a pyometra could have possibly developed.

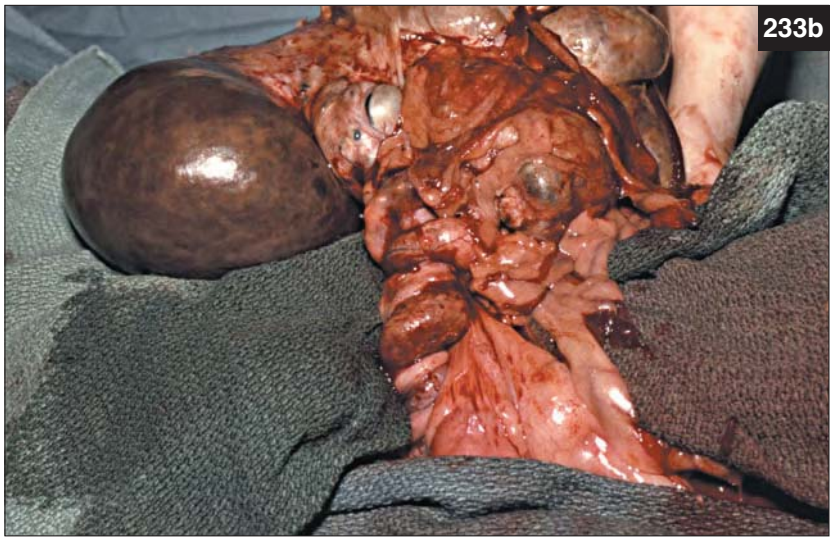


231a–c Hyperestrinism. This Poodle has cystic ovaries and shows all the classic morphologic features of hyperestrinism including trunkal and posterior alopecia, skin hyperpigmentation, prominent nipples, and an edematous vulva. These signs will rapidly disappear after ovariohysterectomy.

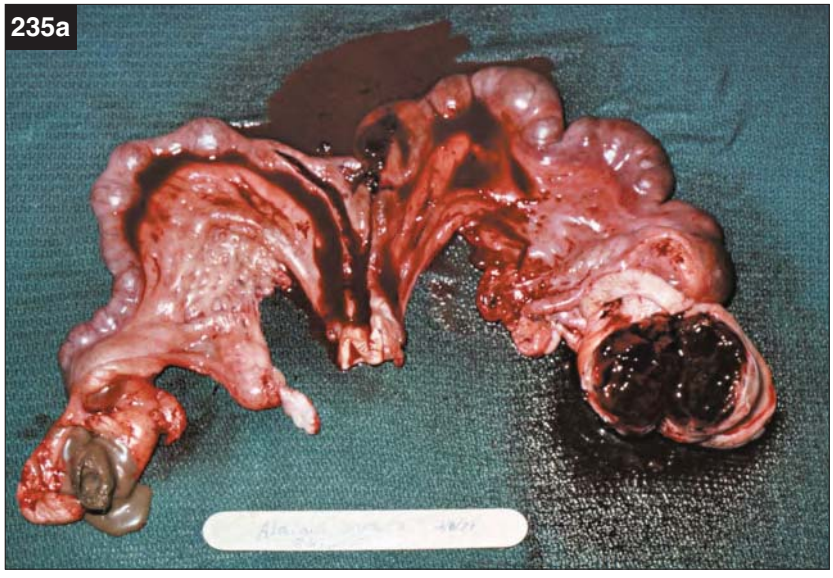


232a–d Hyperestrinism. Male dogs can have feminization as a result of any of the three testicular tumors (Sertoli, seminoma, or interstitial cell or Leydig), with the cryptorchid Sertoli cell tumor having the highest incidence. This Poodle had an intraabdominal Sertoli cell tumor. Note the dog's prominent mammary development (**232a, b**), the radiograph showing the retained testicle (arrow) (**232c**), and the surgery view of the specimen (**232d**).

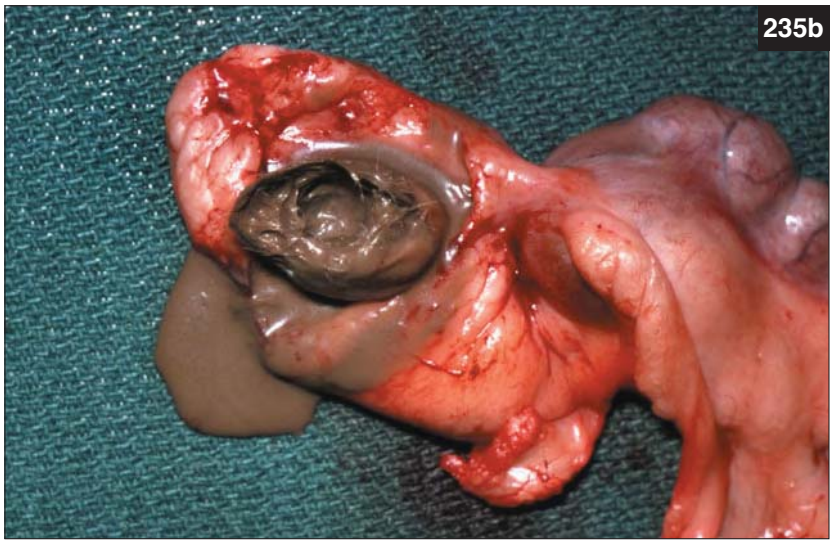
233a, b Hyperestrinism. This posterior view of an intact male German Shepherd Dog shows the classic signs of hyperestrogen dermopathy, namely the alopecia and hyperpigmented skin along the posterior thighs and perineum (**233a**). The dog was examined primarily for his 'abdominal discomfort'. Also note the single distended testicle; the other was located intraabdominally as a torsed necrotic Sertoli cell tumor (**233b**).



234a, b Hyperestrinism. This Boxer shows the classic signs of hyperestrinism including an edematous vulva (**234b**), ventral and caudal skin hyperpigmentation, and prominent nipple development (**234a**).

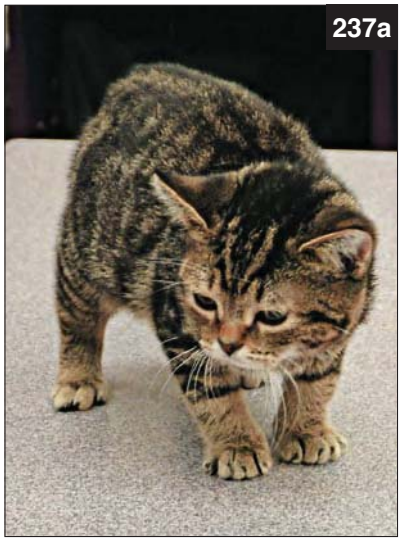


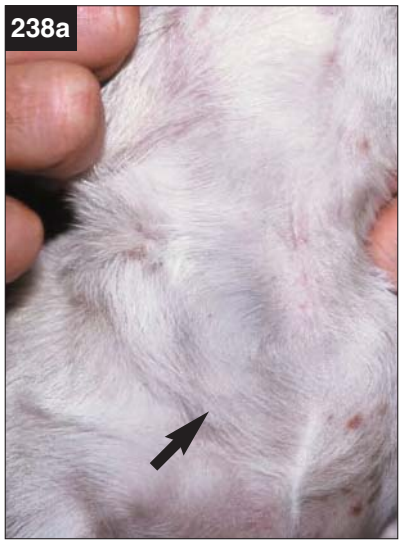
235a, b Hyperestrinism. This surgical specimen is from the Boxer in **234**. It shows a granulosa cell tumor on the right (**235a**), which caused the feminization, and a teratoma on the left (**235b**). This dog also had a pyometra (**235a**), which was incised for demonstration purposes. A preoperative hemogram would be of value in order to assess for any estrogen-induced bone marrow hypoplasia.



236 Hypothyroidism. The 'quiet' disposition of the hypothyroid Bulldog on the right compared with the alert Bulldog on the left illustrates the lethargy that can accompany this disorder. In most clinical situations the demonstration of a low serum total thyroxine level is adequate for diagnosis.

237a, b Hypothyroidism: congenital, feline. Congenital hypothyroidism is rare in the cat. This particular cat had a barely detectable serum thyroid level. At 7 months of age she is much smaller than her littermates and comparatively deficient mentally. The serum thyroxine level was less than 12.8 nmol/l (1.0 μg/dl). (Images courtesy Dr A Specht)



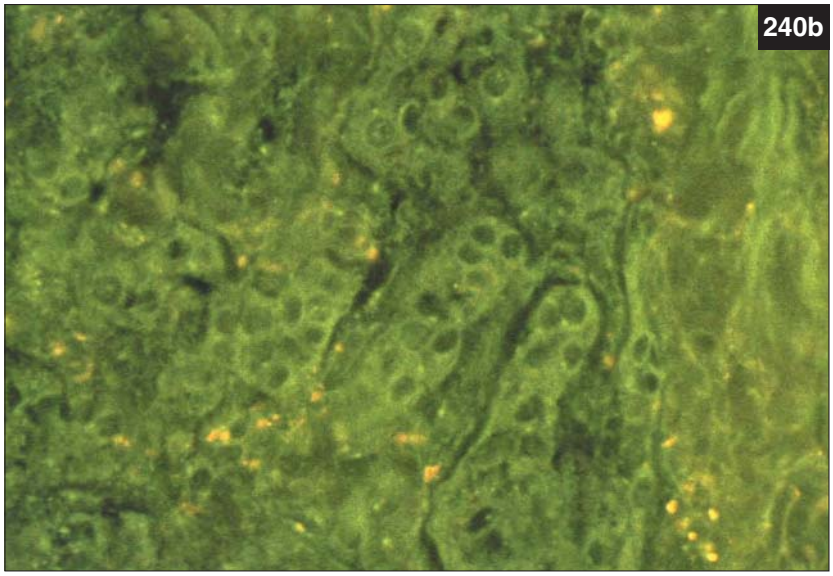


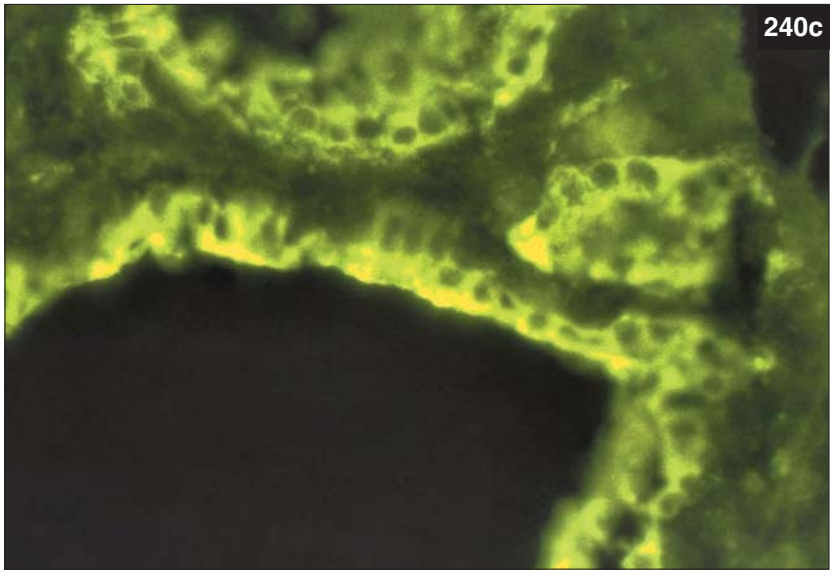
238a, b Hypothyroid iodine deficiency.
This 2-year-old female Chihuahua shows a goiter on her right cervical area (arrow) as a result of diet-caused iodine deficiency (**238a**). Also shown is mammary gland development (gynaecomastia) due to the accompanying hyperprolactinemia caused by the hypothyroid condition (**238b**).

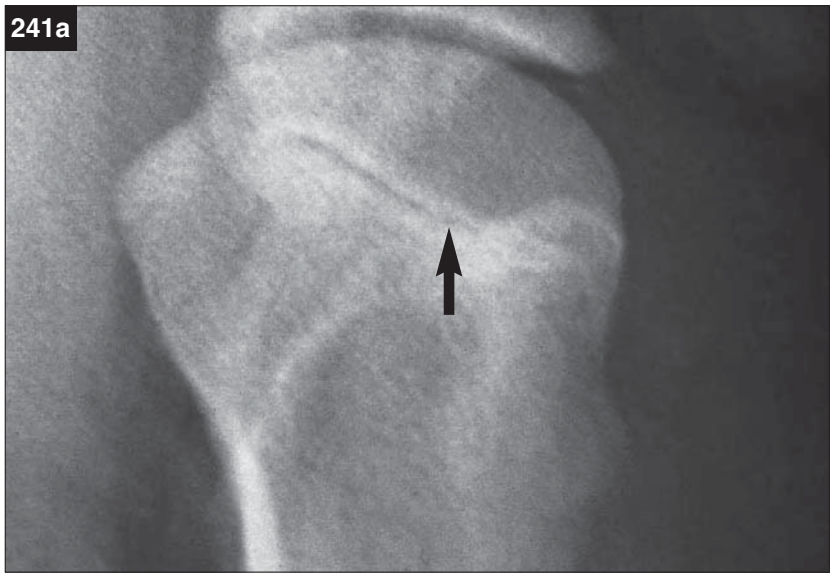
239a–c Hypothyroidism.
This 4-year-old female neutered Doberman Pinscher was referred for a normocytic normochromic anemia (PCV 0.3 l/l [30%]) of unknown cause. She was diagnosed as hypothyroid and responded very well to thyroxine replacement treatment. Shown are before (**239a, b**) (note the 'pathetic' facial expression) and after (**239c**) treatment images of this dog.

240a–c Hypothyroidism. The 'pathetic' facial expression in this female Weimeraner illustrates her severe hypothyroid condition (myxedema) (**240a**). She also had concurrent hypoadrenocorticism, which was due to autoimmune polyhypoendocrinopathy, as proven with an indirect immunofluoresence test on adrenocortical and thyroid tissue templates (**240b, c**).


240a


240b


240c



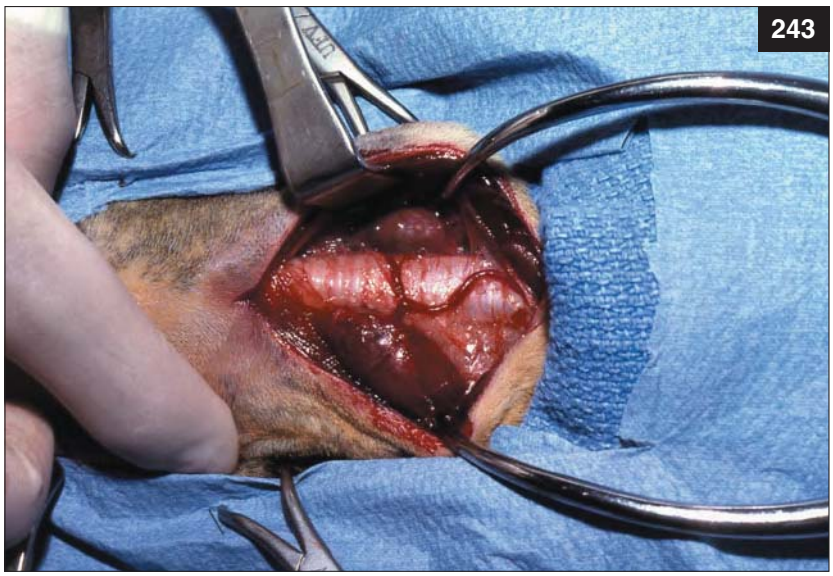
241a–c Hypothyroid neuropathy.
This 2 to 3-year-old Labrador-cross dog with early onset hypothyroidism demonstrated delayed closure of the growth plates (**241a** – arrow) and other abnormalities that included hypothyroid neuropathy. Her neurologic abnormalities included limb weakness, a dysconjugate gaze, and vestibular dysfunction (**241b**). All signs resolved with thyroid hormone replacement treatment (**241c**).

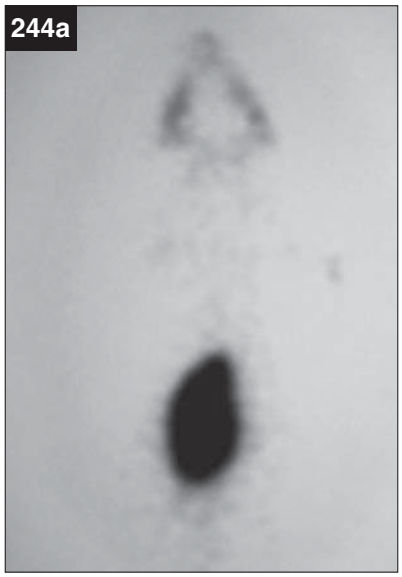
242a, b Hyperthyroidism: methimazole hypersensitivity. This hyperthyroid cat (**242a**) was being treated with the antithyroid drug methimazole. Note the periocular signs of inflammation associated with methimazole-induced hypersensitivity. In the other cat (**242b**), facial hypersensitivity dermatitis accompanied by severe pruritis caused the signs in the temporal region. The condition can be severe, requiring discontinuation of the drug and the selection of an alternative method of treatment.

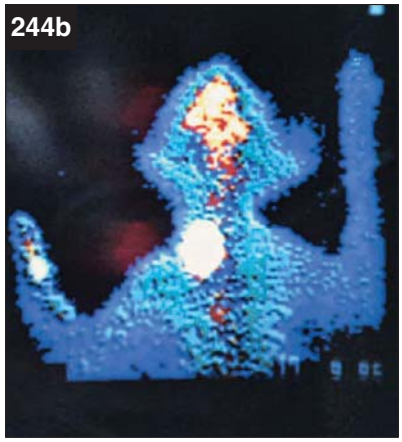

242a


242b

243 Hyperthyroidism. Seventy percent of all hyperthyroid cats have bilateral involvement caused by adenomatous hyperplasia, as seen in this surgical view. Surgeons must be careful to avoid traumatizing the recurrent laryngeal nerve during thyroidectomy and to preserve one of the parathyroid glands.


243

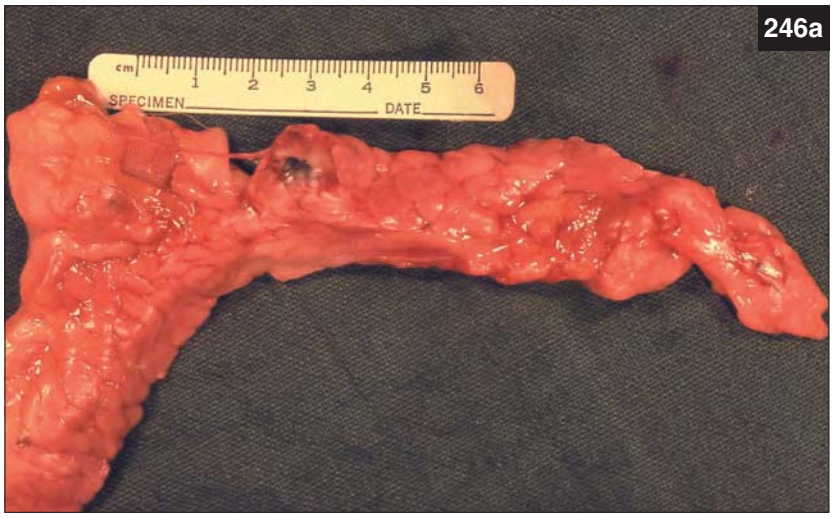


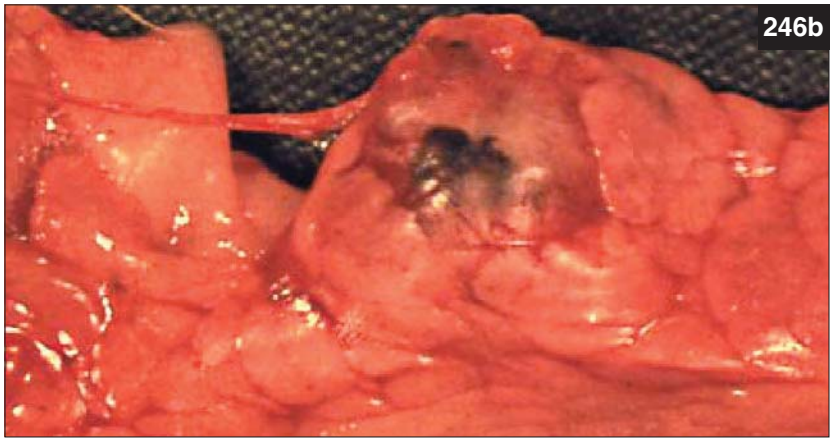


244a, b Hyperthyroidism. This is a technetium scan of a hyperthyroid cat showing a large goiter that has descended toward the thoracic inlet. Sometimes, ectopic thyroid tissue can be visible.

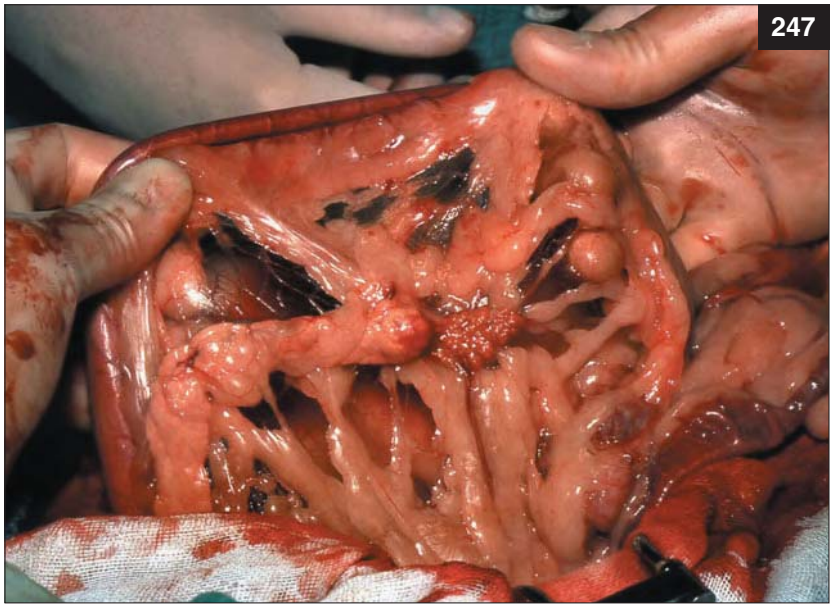
245a, b Hyperthyroidism. This female cat showed the classic signs of hyperthyroidism, including the anxiety shown here. In addition, the body temperature was elevated, as was the heart rate. The cat had a typical history of weight loss despite an increased appetite, and she responded well to radioiodine treatment.

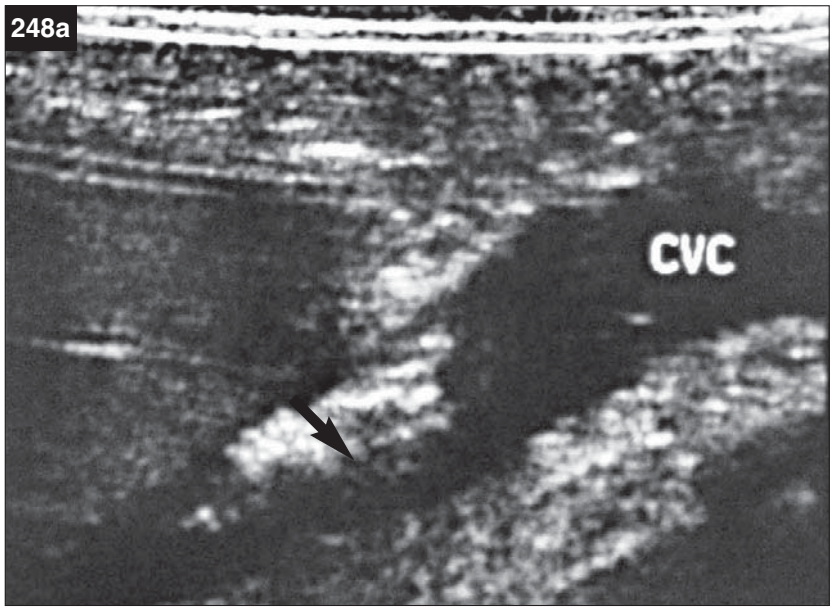
246a, b Insulinoma.
Over 90% if not all canine beta islet cell tumors are adenocarcinomas. Diagnosis rests on demonstrating hyperinsulinemia with concomitant hypoglycemia. This particular specimen (**246a**) would require substantial surgical dissection, and this would increase the likelihood of acute pancreatitis postoperatively. Metastasis to the liver is common. The close-up image (**246b**) shows the darkly pigmented insulinoma, which is commonly seen in endocrine tumors because of their increased vascularity.

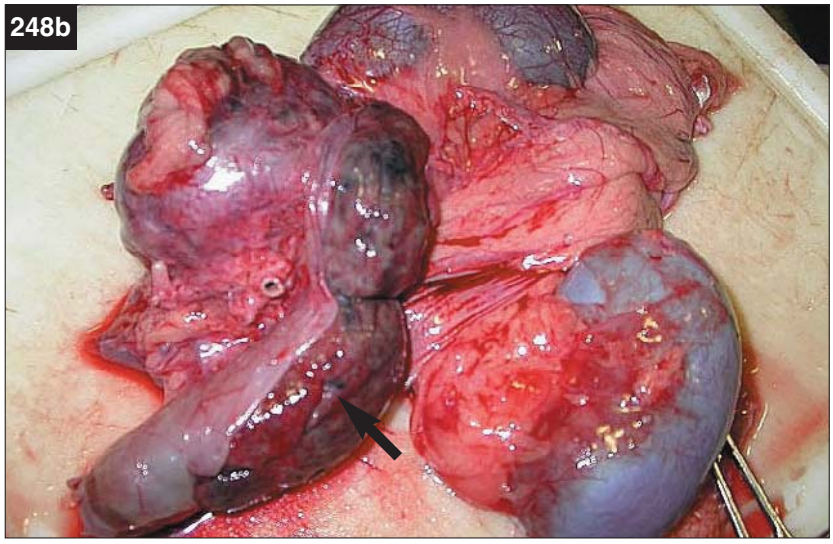




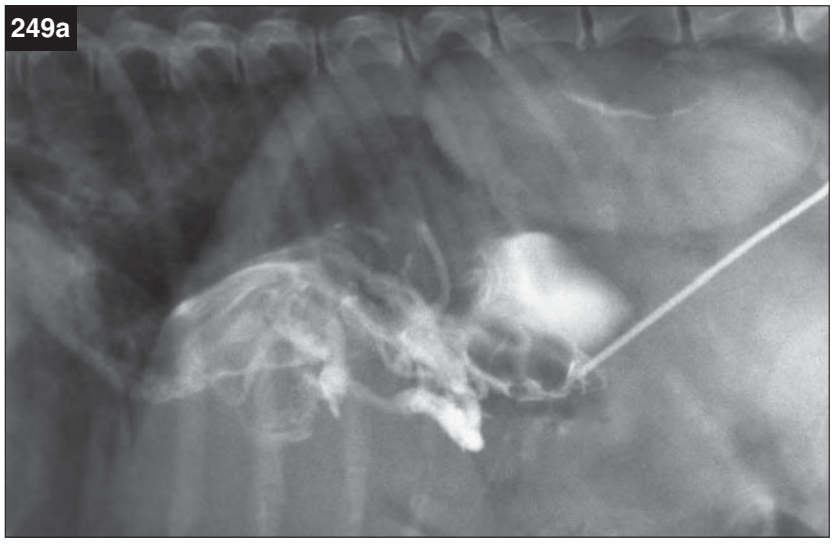
247 Insulinoma.
This beta islet cell tumor in a dog was easily resected and with minimal trauma to the pancreas. Surgical recovery was uneventful, but the tumor was still an adenocarcinoma and could be expected to reappear within the next 12 months. This would be heralded by a recurrence of hypoglycemia.



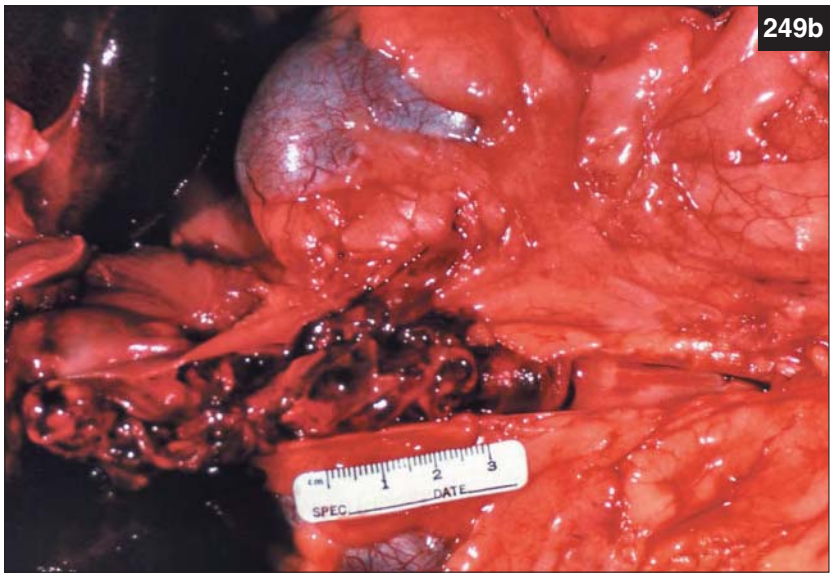




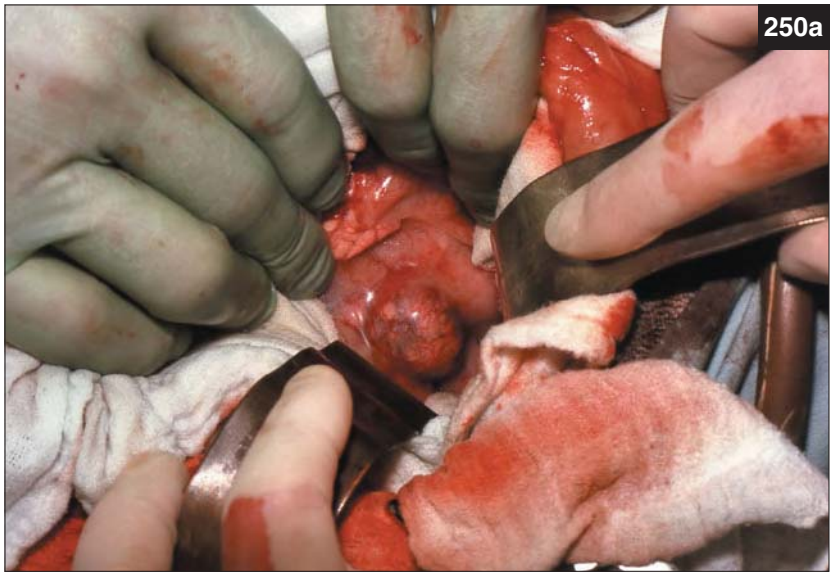
248a, b Pheochromocytoma. Pheochromocytoma is a rare tumor of the adrenal medulla. It has a malignancy incidence of approximately 50%. The ultrasonogram image (**248a**) shows a malignant pheochromocytoma invading a dog's caudal vena cava (arrow); a postmortem view of the same lesion is shown (**248b** - arrow). Hypertension would be expected if the tumor was secreting catecholamines, especially norepinephrine.

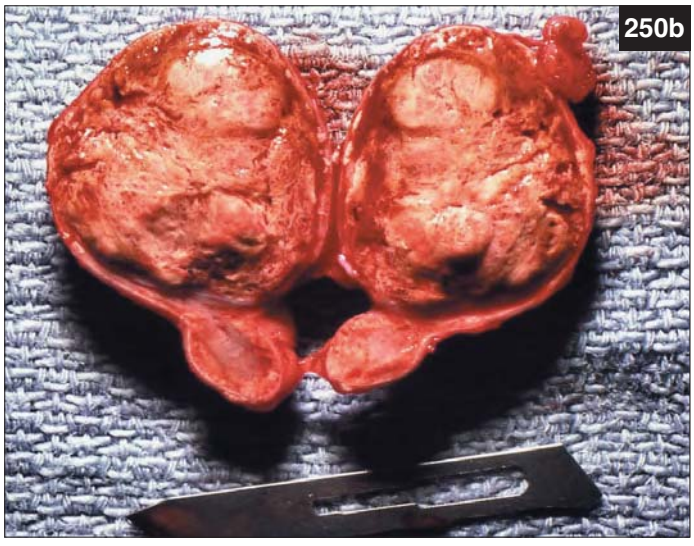


249a, b Pheochromocytoma. The vena cavagram (**249a**) shows a filling defect caused by an invading pheochromocytoma. The postmortem lesion is also shown (**249b**). This dog's clinical signs were related to its modified transudative ascites, which was of unknown cause until the laparotomy and necropsy were performed.



250a, b Pheochromocytoma. A surgical view of a noninvasive pheochromocytoma is shown (**250a**); the same specimen is shown after its successful resection (**250b**). Careful dissection and close blood pressure monitoring are essential to help avoid and detect any rapid onset of hypertension. Always remember to treat with alpha-blockers before administering beta-blockers in hypertensive patients with pheochromocytoma. This is in order to avoid causing severe hypertension.





251a, b Hypopituitarism. This breed-specific condition is the most common type seen in the United States, where it affects the German Shepherd Dog. Note the fine puppy-like (lenugo) hair coat. Hypothyroidism might be clinically prevalent, but adrenocortical function remains normal.

252 Mammary fibroepithelial hyperplasia. This young female Great Dane has mammary fibroepithelial hyperplasia that on palpation resembles a 'cluster of grapes'. This is a benign condition typically involving most or all of the glands simultaneously. It should not be confused with the typical mammary carcinoma, which is nodular and firm. Fluid filled cysts have been noted in some young dogs with this disorder. It can resolve spontaneously, after ovariohysterectomy, or by treating with a progesterone receptor antagonist.

253 Parathyroid adenoma. The thyroid lobe on the right has a parathyroid adenoma at the apical pole. This dog had hyperparathyroidism, which was causing hypercalcemia and hypophosphatemia. The dog's other parathyroid glands were atrophied because of feedback inhibition caused by the hypercalcemia. This dog might be hypocalcemic postoperatively and must be treated accordingly.

9

Urogenital disorders

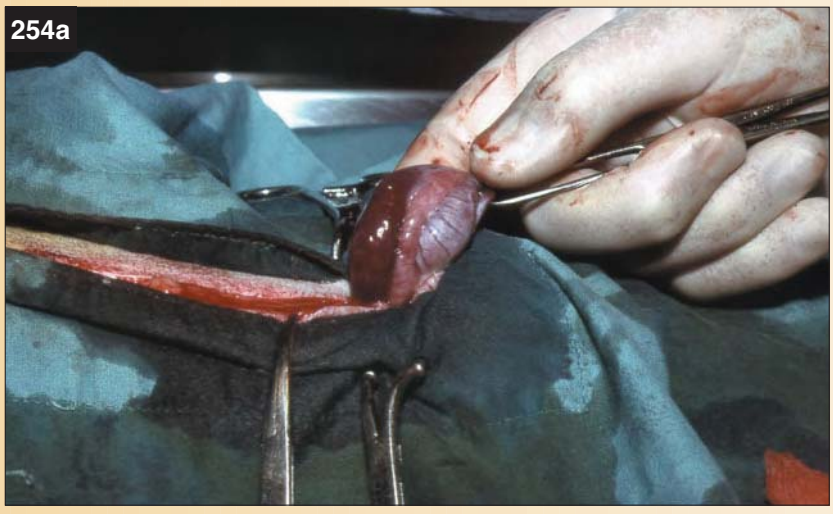
UROGENITIAL is derived from the Greek words ***ouron***, meaning urine, and the Latin word ***genitalis***, pertaining to reproduction. This specialty includes a variety of clinical disorders, because it covers the entire urinary and reproductive systems. Although kidney disorders can be covered in its own nephrology specialty, they can also be included in the urogenital system. Several interesting clinical disorders can therefore be covered in this organ system. Certain diagnostic tests are essential for urinary disorders, including hematology and serum chemistry analysis, urinalysis, and various forms of diagnostic imaging, especially radiography and abdominal ultrasonography.

Abdominal ultrasonography is one of the most helpful diagnostic tools for evaluating the internal genital organs, while a thorough physical examination will be of much diagnostic value. Some of the images that follow might not be that rare, but several of the others might be considered to be highly interesting.

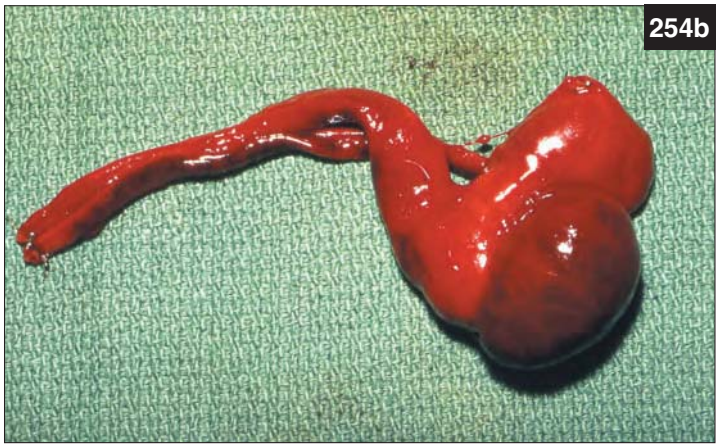
◀ Typical facial features of uremic toxicity in a dog.

Urogenital disorders

- Rule out pyometra in any sick intact female.
- Never let the sun set on a pyo (Garvey, M).
- Murky urine can be caused by: pus, chyle, crystals.
- Bilateral renomegaly means very serious disease: lymphoma, hydronephrosis, pyonephrosis, granuloma, inflammation, subcapsular edema, polycystic kidney.
- Cats: 1 big kidney plus 1 small kidney can mean 1 fibrotic kidney and 1 compensatory hypertrophic kidney.
- Hematuria without stranguria – consider coagulopathy or renal bleed; however, recent renal bleed plus clots – can cause stranguria.
- Male dog plus stranguria – must radiograph to rule out obstructive uropathy.
- Cessation of polyuria in a sick patient – consider oliguria/anuria – a bad sign.
- Oliguric renal failure – hyperkalemia common.
- High output chronic renal failure – normo- or hypokalemia common.
- Emphysematous cystitis – rule out diabetes mellitus.
- PD plus PU plus isosthenuria – consider chronic renal disease, even with normal BUN and creatinine, but watch out for Cushing's.
- Careful on cystocentesis with pyometra – look before your stick!
- Prostate trends: carcinoma – asymmetrical, hard, mid or caudal pelvis; benign prostatic hyperplasia – symmetrical, firm, anterior displacement.
- Empty urine line: anuria, recent emptying, obstruction.
- Always assess urine SG **before** starting fluid therapy.
- BPH: passive penile bleed, normal urination, normal dog.
- Detection of urethral pathology in a female dog, do rectal examination.
- Prostate inflammation can cause the 'prostatic shuffle'.
- For oliguria, try dopamine at 3–5 mg/kg/minute.



254a, b Cryptorchid torsed testicle.
A Huskie puppy presented for vague abdominal discomfort while staring at its flank. Physical examination findings detected only one scrotal testicle, and it was surmised that the other testicle was retained and torsed and was the cause of the abdominal discomfort. The puppy was normal after surgery.


254b

255a, b Anuria.
An empty urine collection bag can be the result of the nurse recently exchanging it for a new bag, a kink or some other cause for obstructed urine flow, or anuria. The latter is most catastrophic and will often require dialysis to allow for waste product removal and the continued administration of parenteral fluids. Treatment options to induce urine production include the administration of furosemide, mannitol, or dopamine. Choice of drug depends on cause.

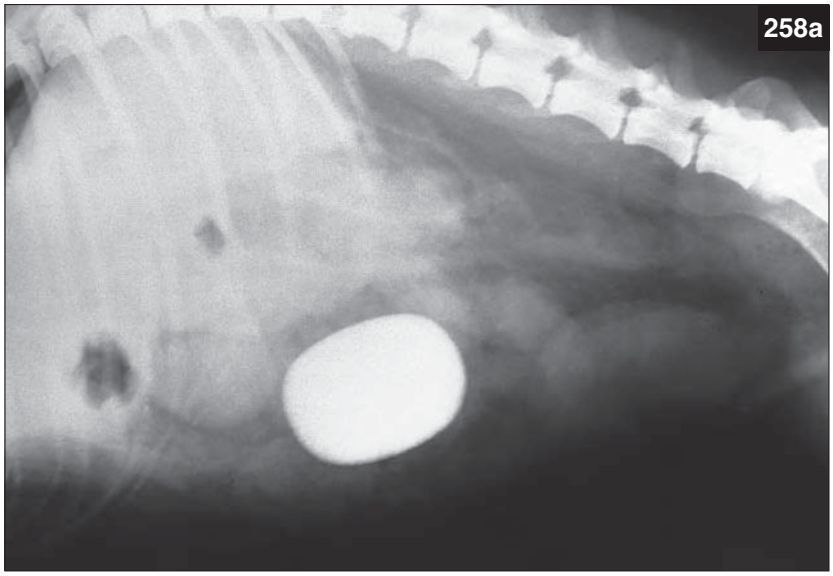

255a

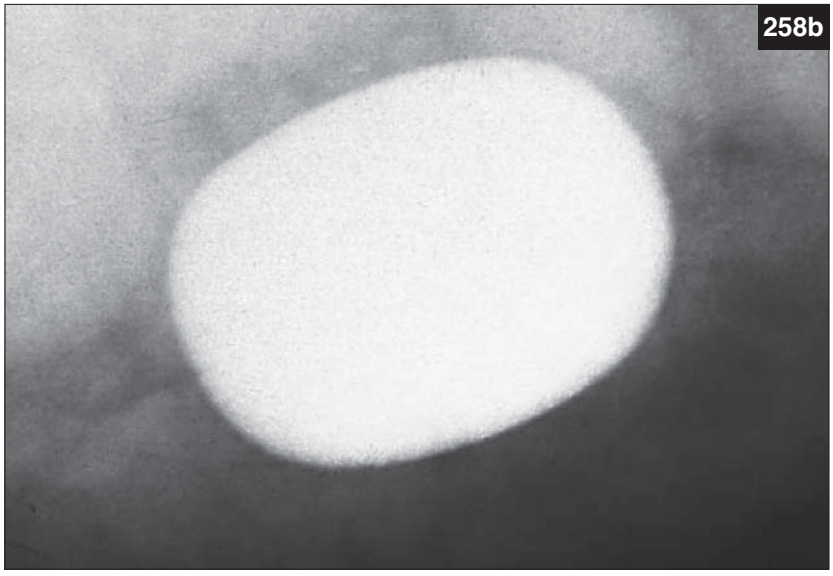

255b

256a, b Metritis/vegetative endocarditis.
These uterine and heart specimens belonged to a Great Dane that contracted postparturient metritis that progressed to bacteremia and vegetative endocarditis. Shown are the placental attachment sites on the infected uterus (**256a**) and the aortic valve vegetations (arrows) (**256b**).

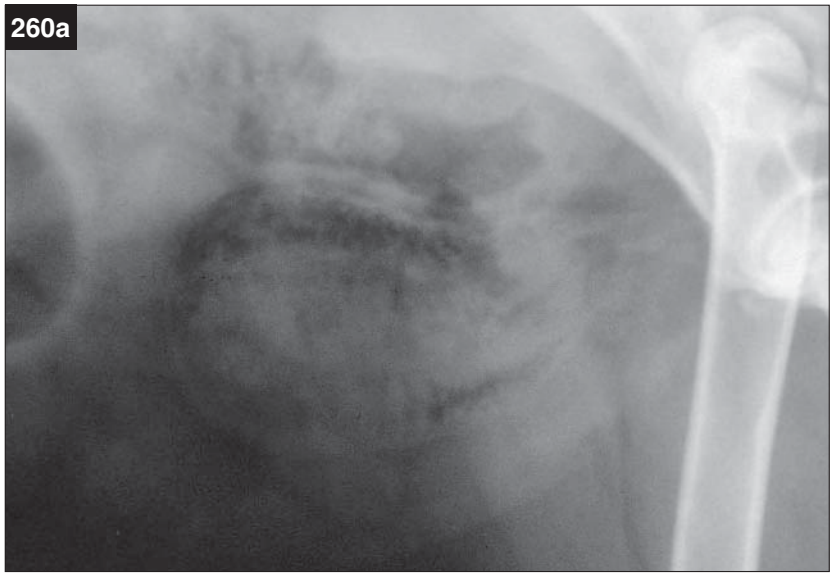
257a, b Cryptorchid: feline.
Cryptorchidism in the cat is rare. These two images show an inguinal cryptorchid during a neutering procedure. Cryptorchidism in cats has about a 0.4–2% incidence compared with dogs, where the incidence is 0.8–10%.

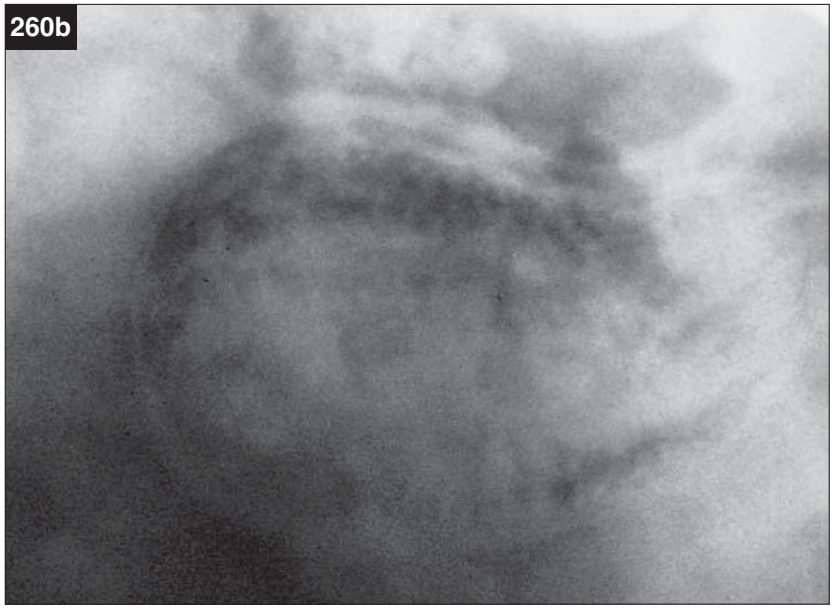
258a, b Cystic calculus: ectopic.
A close examination of this mineral dense intraperitoneal lesion shows that it has a rough edge like a bladder stone and that it conforms to the exact dimension of the urinary bladder. The dog's bladder stone had eroded through the bladder wall and caused uroperitoneum.





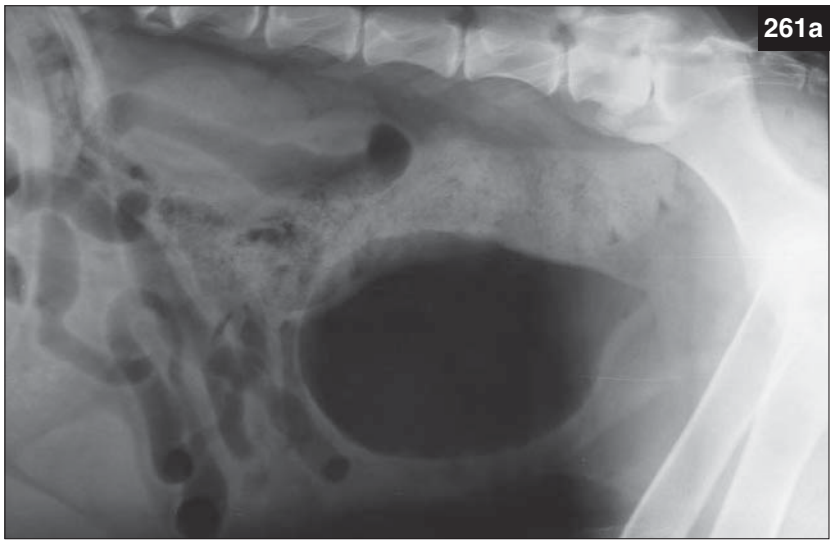
259 Fractured os penis.
This is an uncommon cause of hematuria in the dog.
The radiograph shows a fractured os penis that occurred subsequent to the dog being kicked.

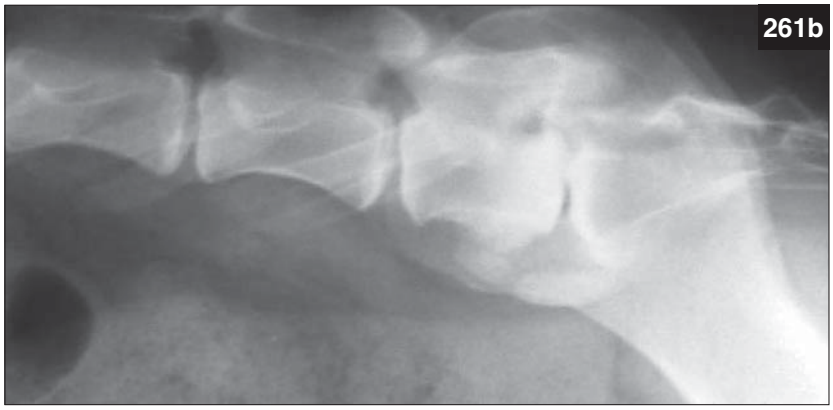




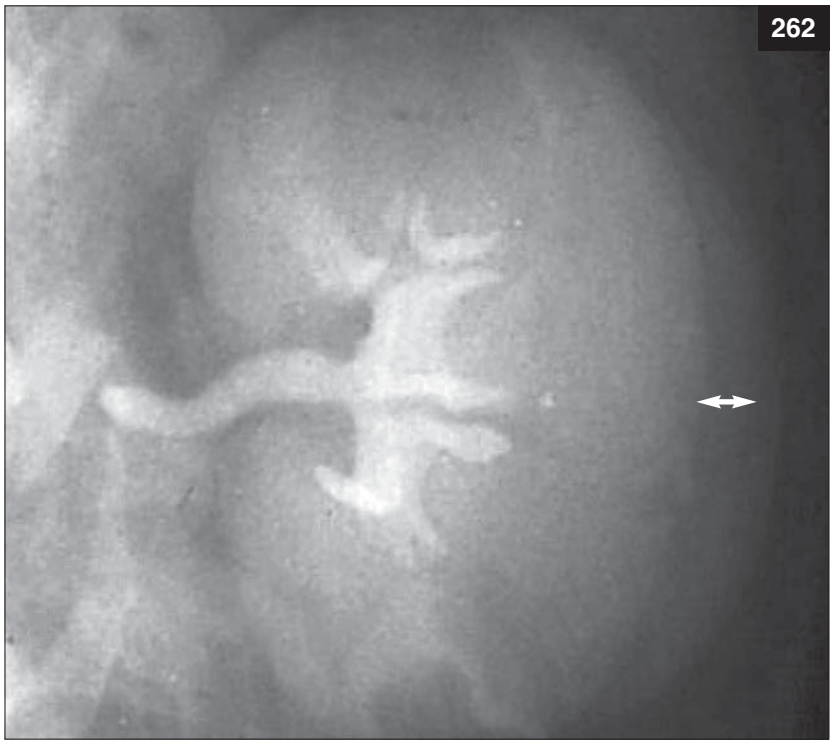
260a, b Emphysematous cystitis.
These lateral radiographs show emphysematous cystitis in a dog with diabetes mellitus. The gas is a result of infection with a glucose fermenting organism such as *E. coli.*

261a, b Emphysematous cystitis.
This is another form of emphysematous cystitis in a dog, with a lumbar myelopathy and loss of bladder control causing urine retention. The urine retention predisposed to secondary infection with a gas producing bacteria such as ***Proteus*** species or *E. coli.* The uninformed reader of this radiograph (**261a**) would think that somebody had injected air into the bladder for a pneumocystogram contrast study, but this was not the case. There is spinal pathology involving L7 and S1 (**261b**).



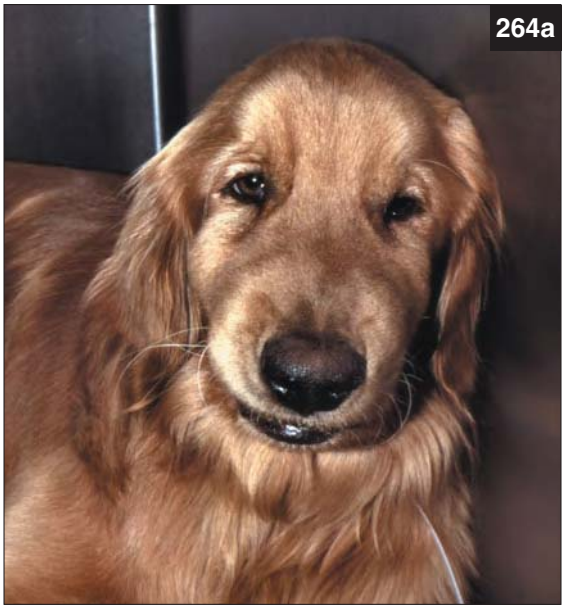


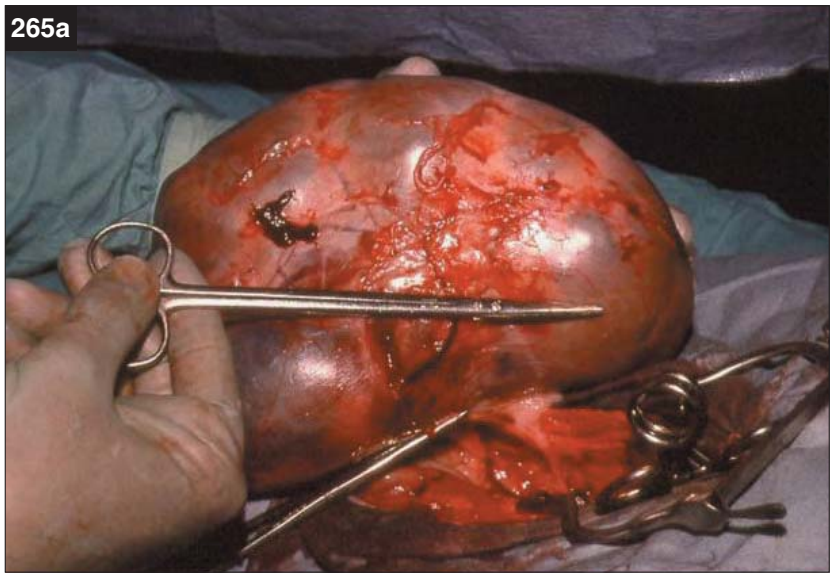
262 Renal subcapsular edema.
Note the halo (arrow) around the perimeter of the greater curvature of this kidney in a cat with acute renal failure. The subcapsular edema is a result of the lymphatic leaking that accompanies the parenchymal swelling. This can occur in acute renal failure, as shown here.

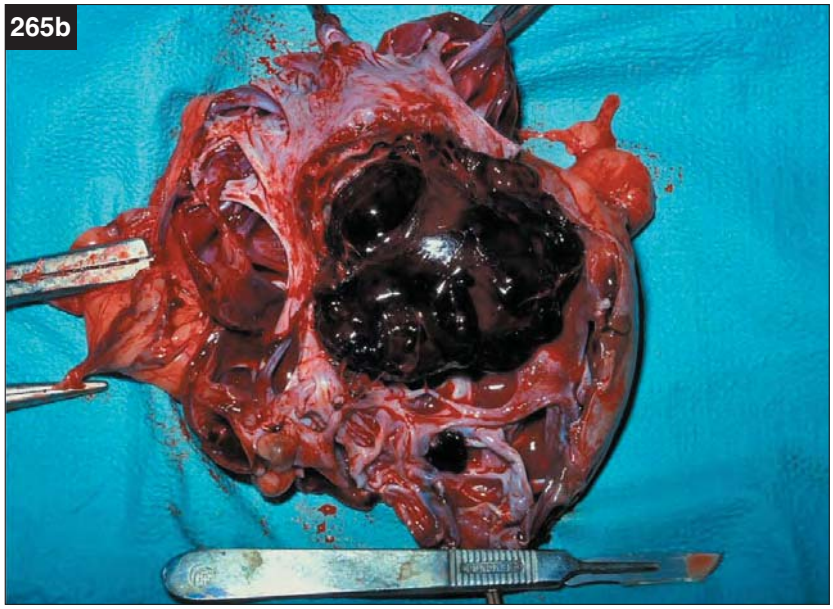


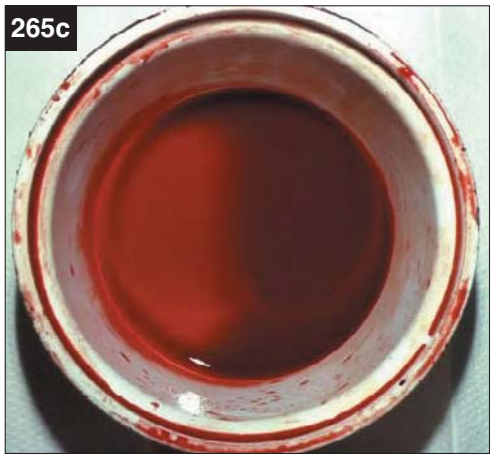
263a–d Genital infarction. This young Malamute had an acute and massive infarction of its external genitalia after an attempted mating on an outside balcony in winter time. The exact cause was never identified. Penile amputation and scrotal ablation was performed after an accompanying episode of DIC was treated successfully with heparin and supportive treatment. Shown are the gangrenous genitalia before and during surgery.

264a, b Floating teeth and renal osteodystrophy.
The maxilla of this young Golden Retriever displays the typical floating teeth associated with resorption of the alveolar dentes ligament caused by renal osteodystrophy. This dog also had maxillary bone proliferation. This can be seen both from the buccal and external aspects.



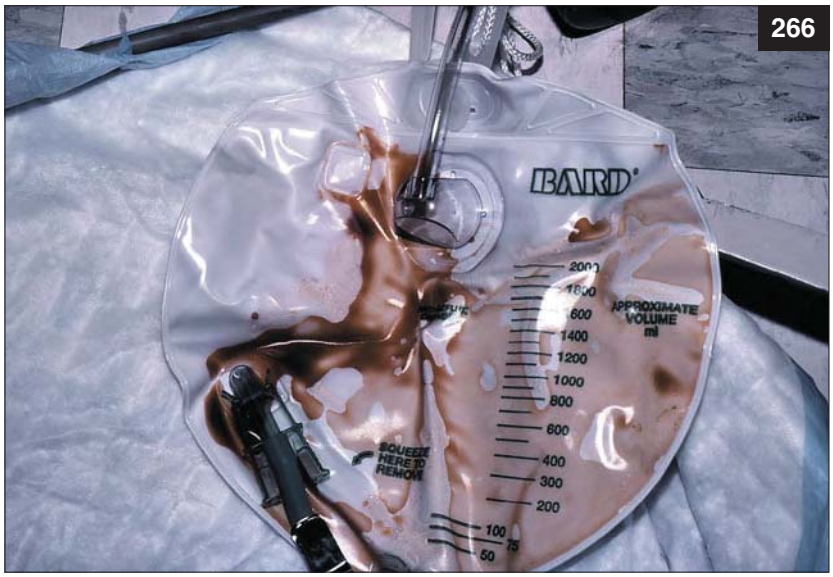




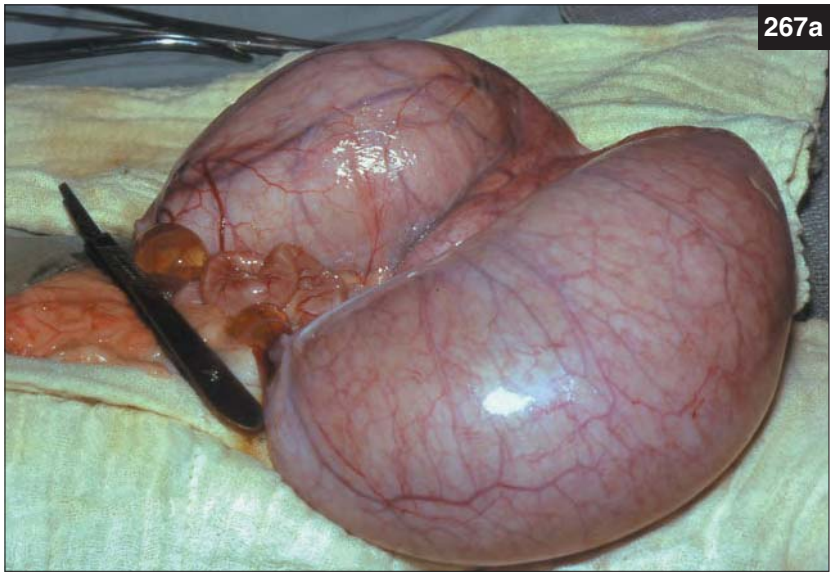


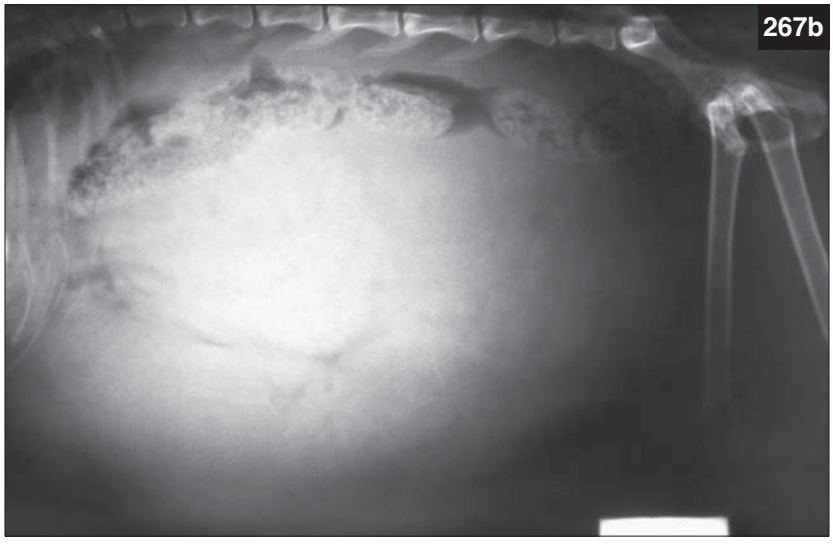
265a–c Hydronephrosis with hemorrhage.
Rarely, dogs with hydronephrosis can have a spontaneous bleed within the affected kidney that can cause severe systemic hypotension (**265a, b**). Gross hematuria can occur, as shown in the urine sample (**265c**). Hydronephrotic kidneys can also hemorrhage from direct trauma.

266 Pigmenturia: myogloginuria.
Myoglobin is tubulotoxic and can cause acute renal failure. Myoglobin tubular toxicity can be prevented by giving the patient bicarbonate parenterally in order to alkalinize the urine. The amount of urine in the collection bag is scanty because the dog was oliguric and this had progressed to anuria.



267a, b Pyometra.
Cats can acquire pyometra that reaches a remarkably large size (**267a**). Their ability to tolerate this problem for as long a period of time as they do is also remarkable. Note on the radiograph (**267b**) how the uterus occupies most of the abdominal cavity and displaces the abdominal viscera cranially and dorsally.





268a, b Chronic renal fibrosis.
The dog that had these severely fibrotic kidneys (**268a**) suffered from advanced uremia, polydipsia and polyuria, and renal osteodystrophy. Note the highly irregular surface and margins due to the tissue contraction brought about by the fibrosis. The latter problem resulted from advanced secondary renal hyperparathyroidism. The hyperplastic parathyroid glands are shown. The dog (**268b**) shows typical facial features of uremic toxicity including marked mental depression, 'muddy' oral mucous membranes, and 'uremic frost' on its nose. Uremic frost refers to a crystalline deposit found on the skin in humans associated with uremia. In dogs this can occur on the nasal epithelium.

269a, b Renal hematuria.
The ureteral catheter placed at surgery localized the right kidney as the source of this dog's hematuria (**269a**). The diagnosis was initially thought to be idiopathic hematuria, but the resected kidney shows the cause as a bleeding papilloma deep in the renal pelvis (**269b**).

270 Hypoproteinemia and anasarca.
Glomerulopathy in this cat caused its hypoproteinemia and anasarca. Note the edematous areas under the chin, anterior thorax, and dependent limb regions.

271a–c Renal osteodystrophy: mandible. This dog's mandibular pliability (rubber jaw) (**271a, b**) is a result of renal osteodystrophy accompanying end-stage renal disease. The kidneys of this same dog show a pitted and irregular surface due to chronic renal fibrosis, which progressed to end-stage kidney disease (**271c**). Also shown are enlarged parathyroid glands on the thyroid glands due to secondary renal hyperparathyroidism.

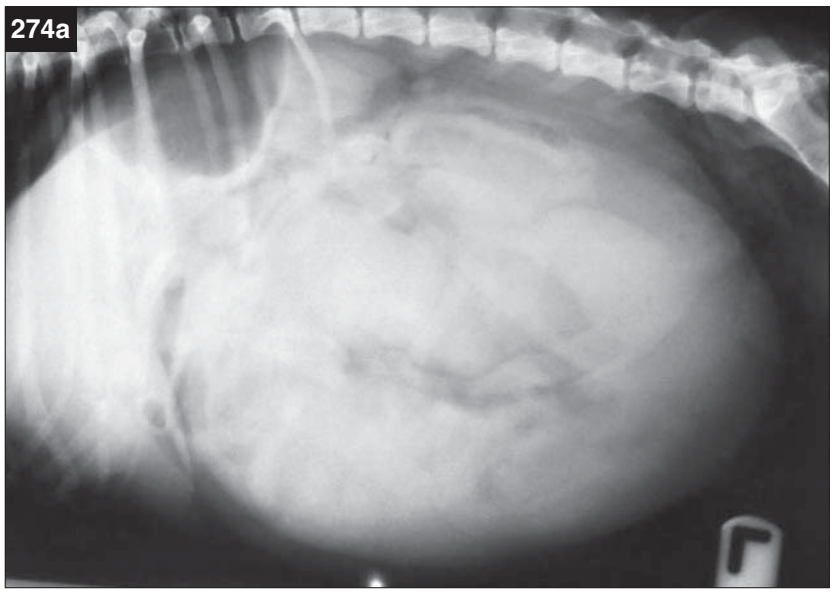
272a–c Renal osteodystrophy: maxilla. Note the maxillary proliferation involving the face of this 18-month-old Golden Retriever (**272a, b**). This is another but more rare form of renal osteodystrophy. The proliferative bony change even caused maxillary venous stasis. These small cystic, end-stage kidneys (**272c**) are from the same dog; they are presumably congenital lesions.


272a


272b

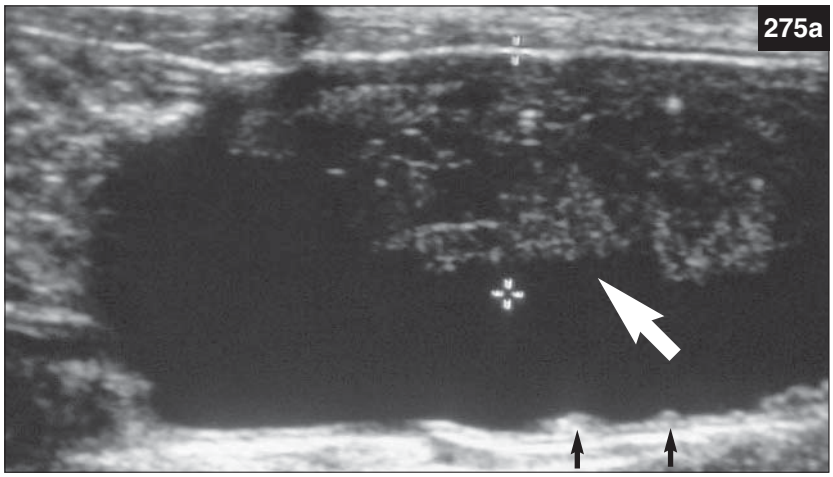

272c

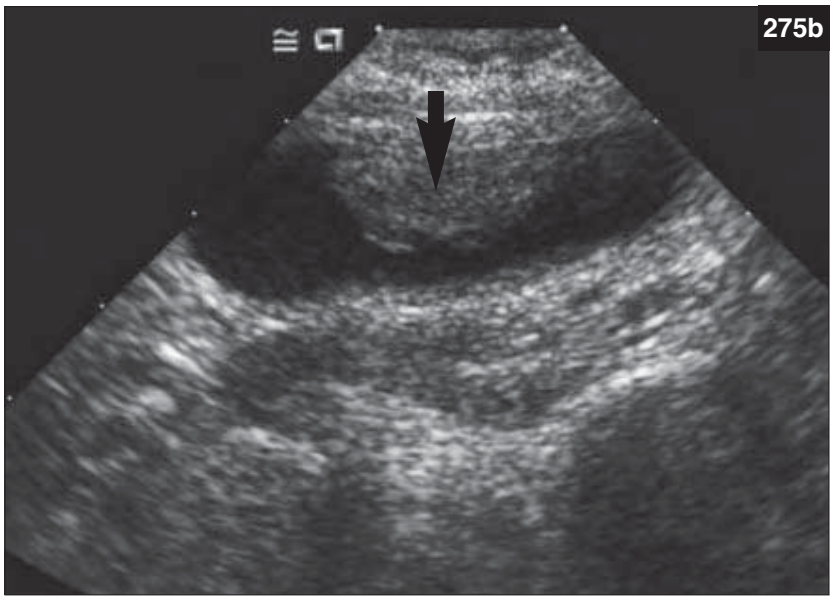
273 Urinary bladder leak.
A cystocentesis was performed on this Pug about 2 hours prior to surgery. The dog had a severely inflamed bladder that had not yet sealed off the needle puncture site that was made preoperatively.

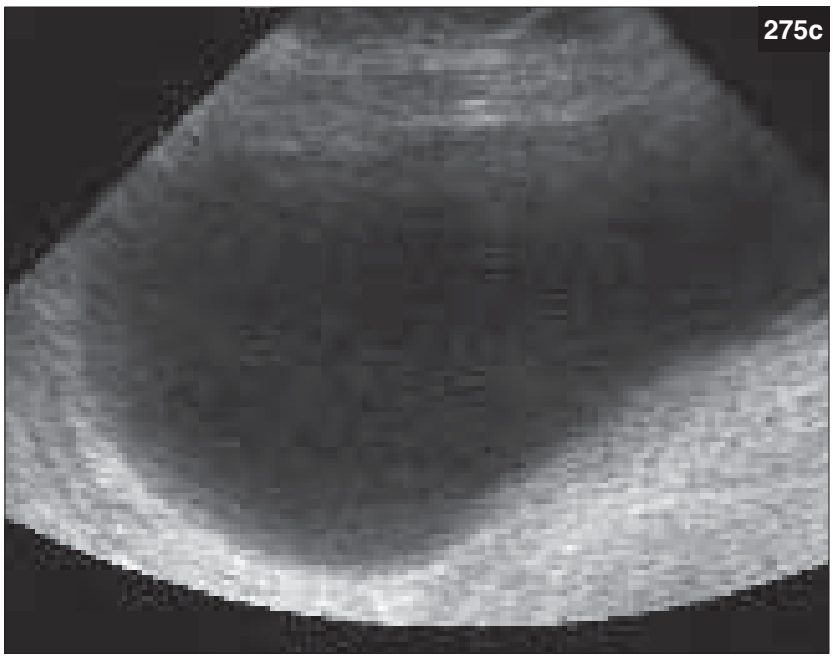


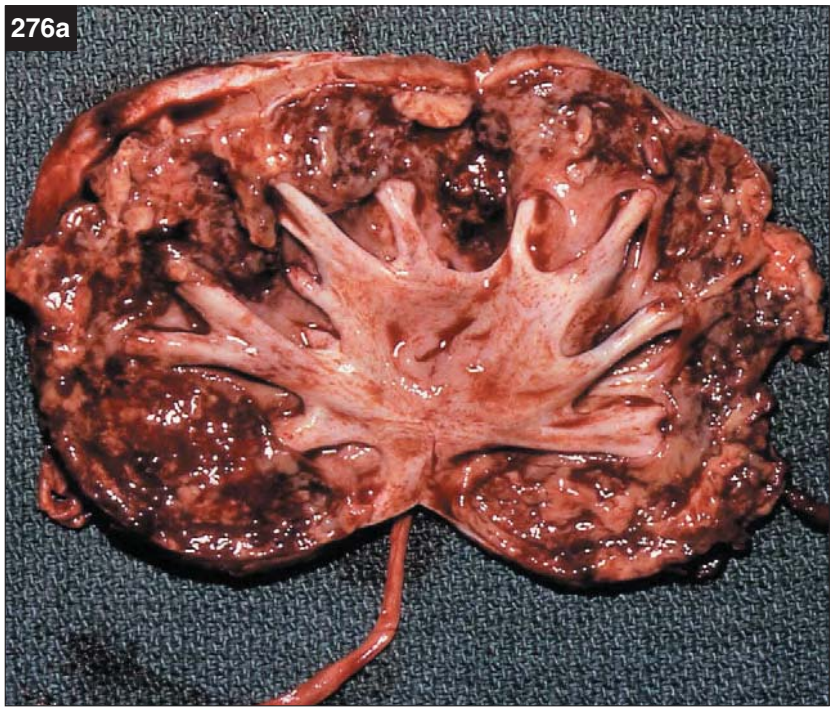
274a, b Uteromegaly: cat.
This cat's abdominal radiograph (**274a**) shows very large uteromegaly. Note the dorsocranial displacement of the abdominal viscera. On surgery this was found to be a pyometra (**274b**). This is not much different from the pyometra shown in **267a**. The reader can appreciate the potential danger in a blind cystocentesis procedure in this patient.

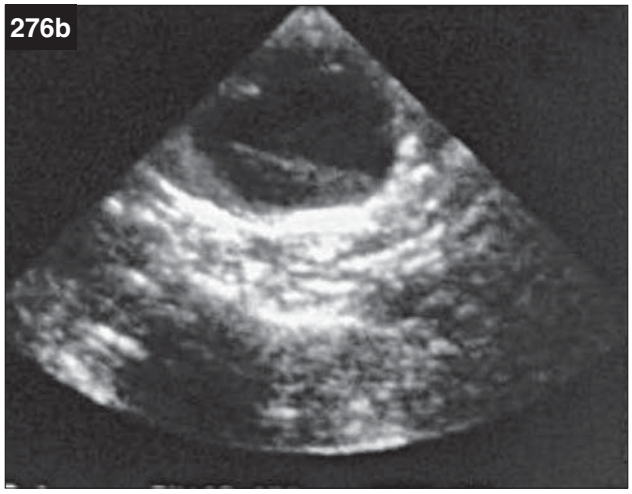
275a–c Transitional cell carcinoma and cystitis. Ultrasonography of the urinary bladder is a helpful diagnostic tool, but it does not always provide a confirmed definitive diagnosis. The ultrasonogram of a dog's urinary bladder (**275a**) depicts small calculi on the ventral aspect of the bladder (small arrows) and a mass lesion involving the dorsal aspect (large arrow). The mass is a transitional cell carcinoma. An ultrasonogram from a cat is also shown (**275b**). This cat also has a soft tissue density on the dorsal aspect of the urinary bladder (large arrow), but in this case it is proliferating inflammatory tissue caused by *E. coli* cystitis, which was tentatively diagnosed based on cytology and culture results obtained from an ultrasound-guided fine needle aspirate specimen. The cat's problem resolved after 2 weeks of antibiotic treatment, as shown in the follow-up ultrasonogram (**275c**).







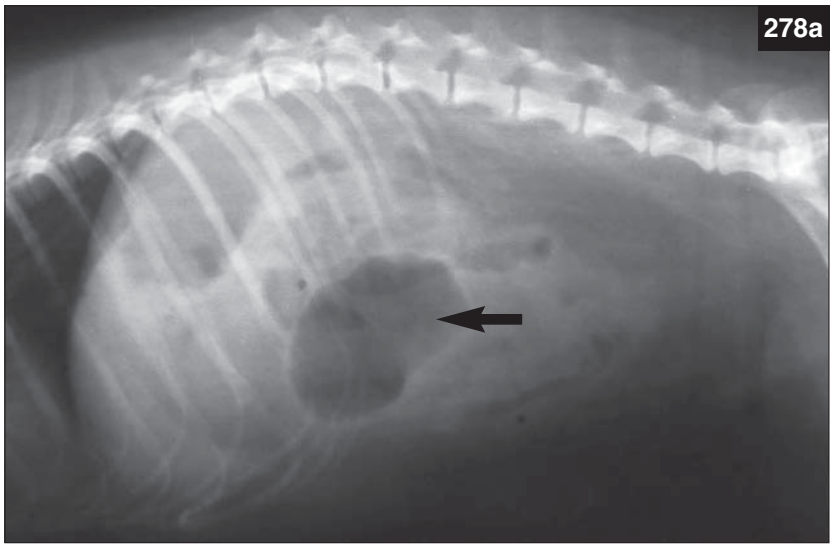


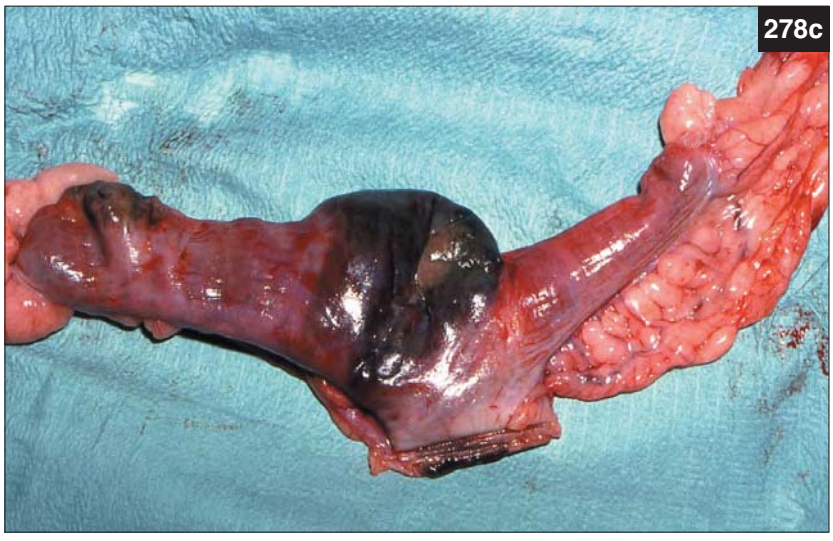


276a, b Pyonephrosis. This kidney was abnormally enlarged, with much of the parenchyma replaced by suppurative exudate (**276a**). The dog's urinalysis was unremarkable because the involved kidney also had ureteral obstruction as a result of the inflammation. The ultrasonogram (**276b**) is from a cat with pyonephrosis, showing renal pelvis dilatation and debris and necrotic parenchyma.

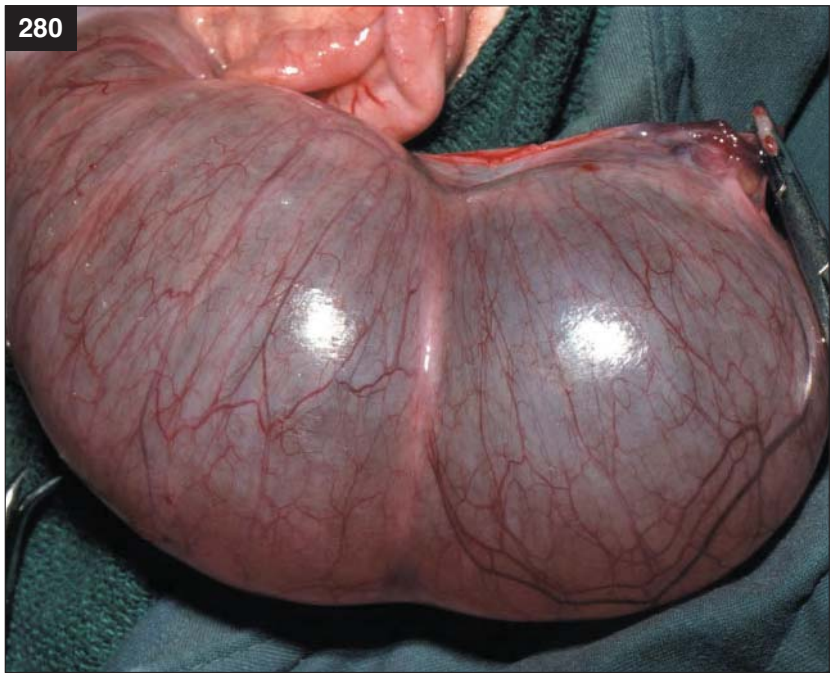
277 Polycystic kidneys. Persian cats are particularly prone to this congenital disorder. These kidneys had progressed to end-stage renal failure. The pathology showing the multiple cysts is obvious in this image. Clinically, the diagnosis is easily made with ultrasonography of the kidneys.

278a–c Uterine necrosis. Focal gangrenous metritis in a mixed breed dog caused severe postpartum sepsis. Shown are lateral and dorsoventral radiographs (**278a, b**) indicating a distended gas-filled uterus (arrow), which was subsequently surgically removed. There is also some loss of abdominal detail, suggesting fluid or peritonitis. The postoperative specimen shows gangrene involving the uterine body and the left uterine horn (**278c**).



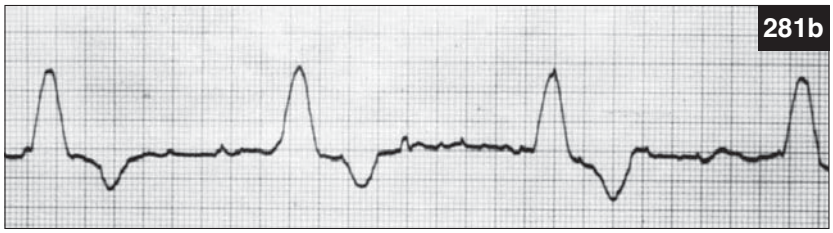


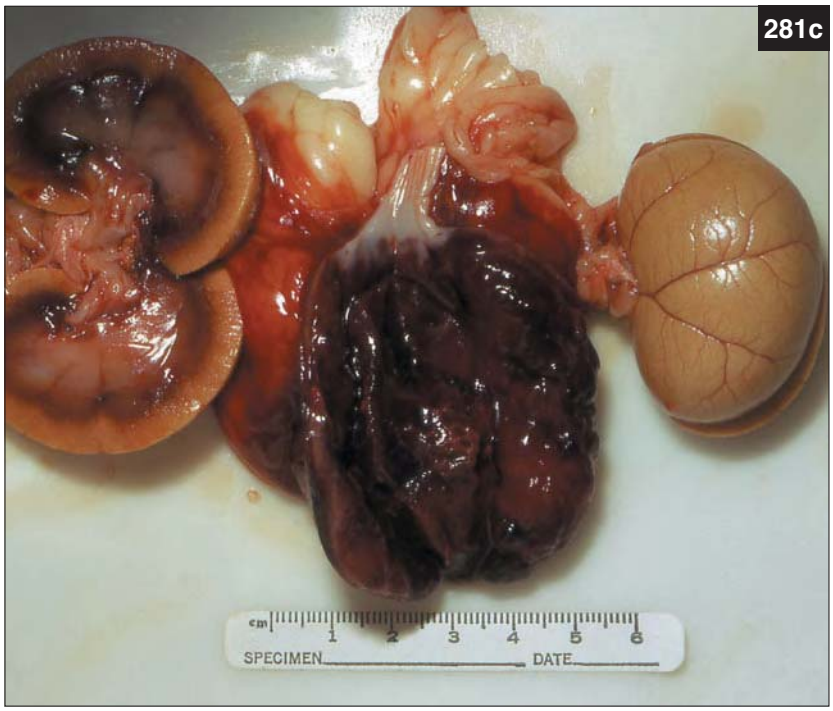
279 Pseudohermaphrodite. This miniature Poodle is a pseudohermaphrodite. Note the penis remnant protruding from the vulva. The primary complaint might be a vulvar discharge or the owner observing the penis protruding from the vulva.

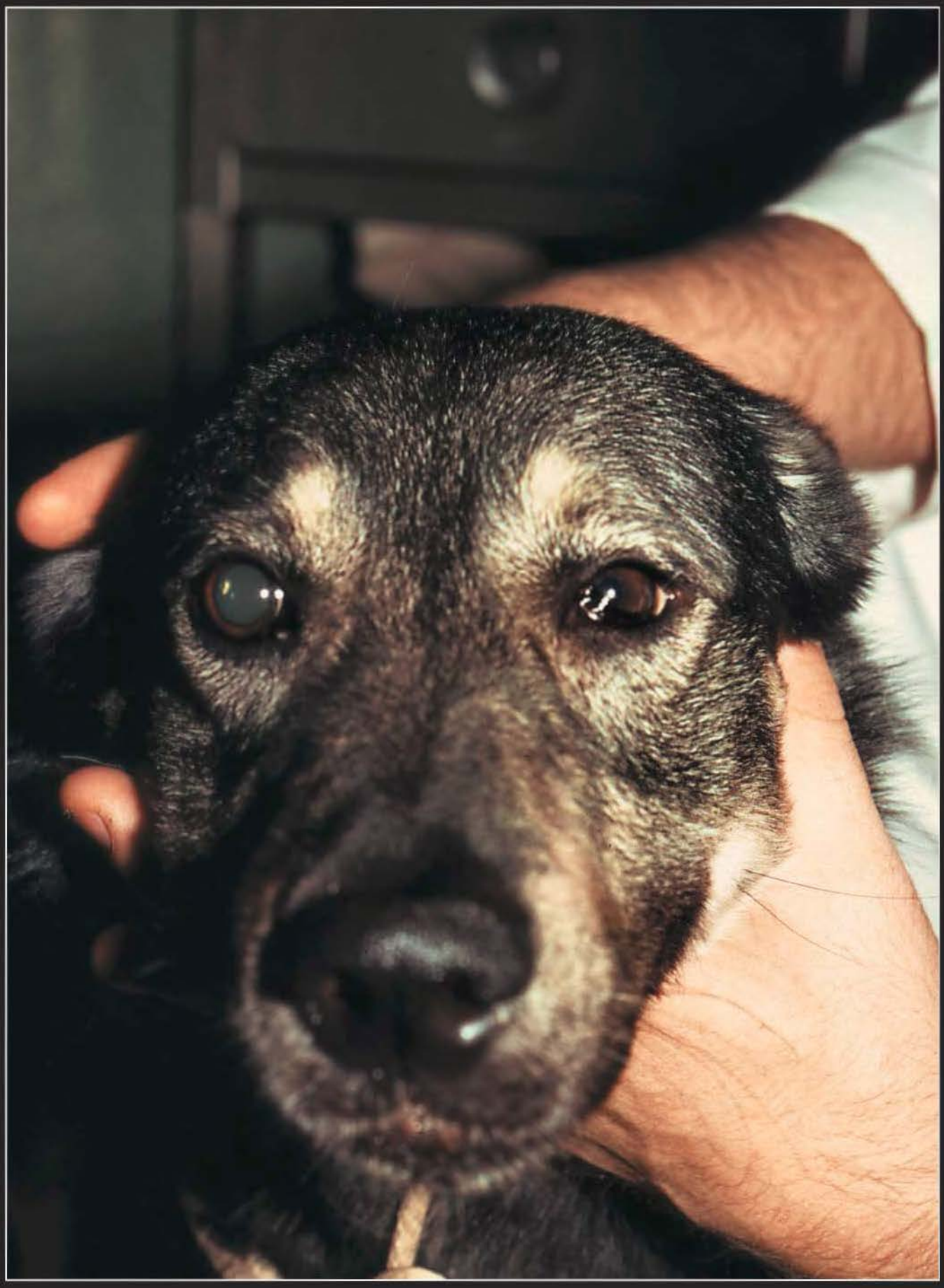


280 Hydrometra. Hydrometra is one of several causes of uterine enlargement in dogs and cats. This cat had obvious abdominal distension.

281a–c Urinary bladder outflow obstruction.
This complicated case of feline urinary bladder obstruction terminated with anuric renal failure due to severe hemorrhagic cystitis, which caused bilateral distal ureteral orifice obstruction (**281a**). The lead 2 electrocardiogram (**281b**) shows aberrant atrial–ventricular conduction, a pattern compatible with an underlying hyperkalemia. The postmortem specimen (**281c**) shows the kidneys and the hemorrhagic urinary bladder.







10

Neurologic disorders

NEURO is derived from the Greek word ***neuron***, meaning 'sinew'. The competent practice of internal medicine is almost impossible without a firm understanding of clinical neurology. This is because many patients can present to the clinician with one disease, only to be complicated by another disorder that can involve the nervous system; for example, a dog or cat with a bleeding disorder that suffers a hemorrhagic stroke or hypoxia causing an epileptogenic focus in the cerebrum.

My mentor taught me that neurology is the queen that shows mastery of a clinician's history taking and physical examination skills. This is the one main discipline where 'A picture is worth a thousand words' comes to life, because it demands the cognitive skills of the clinician. The images that follow will illustrate this well.

◀ Left-sided Horner's syndrome in a geriatric dog.

Neurologic disorders

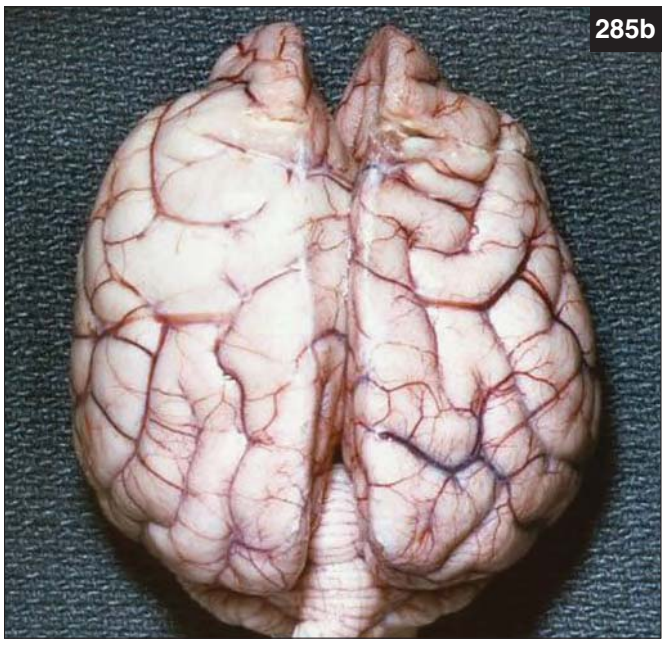
- Rapid onset LMN paralysis – think ticks, organophosphate, botulism, polyradiculoneuropathy, metronidazole, coral snake.
- Cats with dilated pupils and blank stare – think thiamine deficiency.
- Coma – diffuse cerebral, stem, but don't forget metabolic.

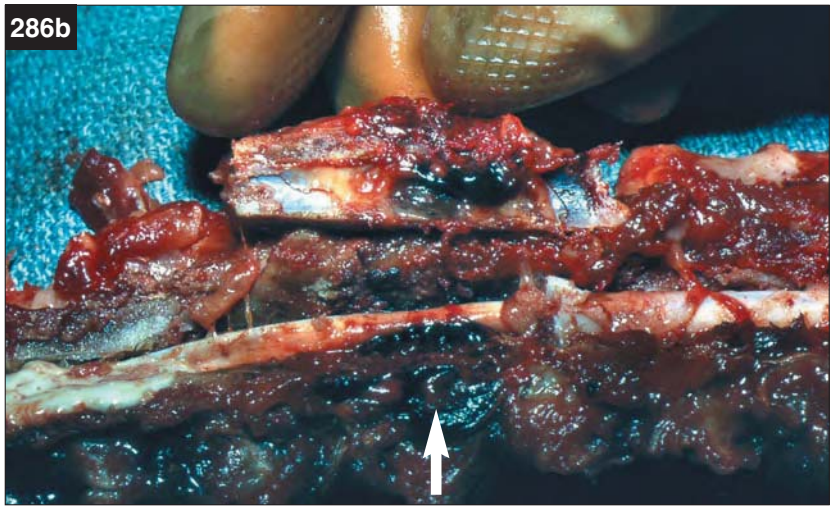
282 Facial nerve pathology. This cat detects enough pain on the right side of its face to close its right eye, indicating that the left trigeminal sensory motor pathway is working. The absent blink on the left side indicates a left facial nerve dysfunction.

283a, b Horner's syndrome. Note the Horner's complex on the cat's right side ipsilateral to the right forelimb weakness (brachial palsy), reflecting pathology involving the nerve roots in the area of C5, C6, C7, and T1-2. Trauma, lymphoma, and neurofibroma or neurosarcoma would be in the list of differential diagnoses.

284 Horner's syndrome. This geriatric dog has characteristic features of left-sided Horner's syndrome (i.e. miosis, ptosis, and enophthalmos). The causes can vary.

285a, b Frontal lobe tumor. This Labrador Retriever has a left frontal cerebral lobe tumor, which caused its dementia, head pressing, and circling (**285a**). Seizures can also occur with this type of lesion. A cerebral lobe tumor is shown involving the left side, as evidenced by the swollen gyri (**285b**). The dog would circle to the side opposite the lesion.

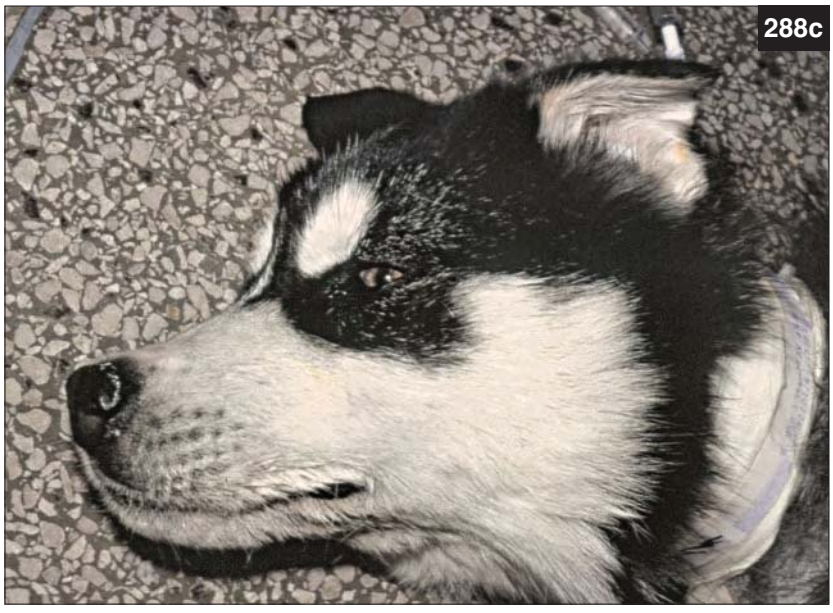




286a, b Schiff–Sherrington posture. The Schiff–Sherrington posture shown in this dog is due to a severe spinal cord lesion in the thoracolumbar spinal cord region. The dog had an acute collapse caused by a bleeding hemangiosarcoma in the epaxial muscles (primary origin) (**286a**) and the floor of the spinal canal, as shown in the postmortem specimen (**286b**). This was the only site of tumor involvement in this dog. (See also images **311a–c**).

287 Anisocoria. Anisocoria is the term used to describe unequally sized pupils. This cat's right pupil is miotic due to pathology involving the ipsilateral sympathetic nerve innervation, thus impairing pupil dilation on the right side. Other features of Horner's syndrome are evident as well, including ptosis and enophthalmos (note the 3rd eyelid prominence).

288a–c Tetanus.
These three images illustrate severe tetanus in a Malamute puppy. The generalized muscle spasticity and the risus sardonicus facial expression are typical of this infection in the dog. The recumbent posture was soon accompanied by impaired ventilation and hyperthermia, which offered a very guarded to grave prognosis.



289a–c Tetanus.
This mixed breed dog acquired tetanus from a contaminated perineal skin wound. Being able to stand, walk, and swallow offered the dog a good prognosis. Treatment at this stage entailed wound care and using an antibiotic such as metronidazole, which would be effective against ***Clostridium tetani***. Tetanus antitoxin would not reverse clinical signs that are already present, but it would help prevent progression of signs from further absorption of toxin from the site of infection.

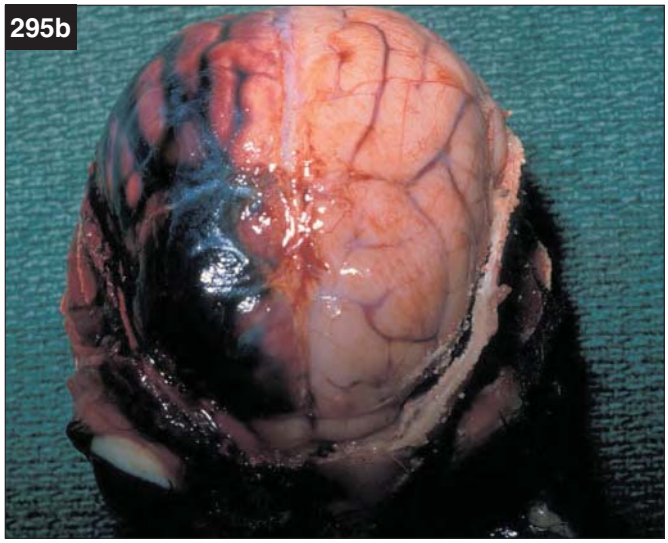
290a–c Tetanus.
Classic risus sardonicus is shown in this 3-year-old female St. Bernard's face (**290a**). She also had classic 'lock-jaw' (**290a, b**), but never lost the ability to stand and walk, albeit slowly and stiffly, during the peak period of her syndrome. Like many other patients with this disease, this dog did not have any noticeable wound, but she was still treated with procaine penicillin. She recovered well.

291a, b Tetanus: cat.
Although cats rarely acquire tetanus, this male cat was one of the unfortunate victims. The cat had extensor hindimb posture and an inability to urinate, which required him to have a urinary catheter (**291a**). He also had spasticity involving his muscles of facial expression. Image **291b** shows the cat's normal facial expression after recovery.

292a–c Myasthenia gravis. This female St. Bernard demonstrates the typical exercised-induced weakness resulting from acetylcholine receptor antibodies interfering at the myoneural end-plates. She was also regurgitating because of esophageal involvement causing megaesophagus. The bitch was responsive to the edrophonium test and to pyridostigmine treatment.

293 Spinal dysraphism.
The Weimeraner is one of several breeds predisposed to this congenital cavitating spinal dorsal column disorder, which causes affected dogs to move with a 'bunny-hop' gait. As the dogs grow, joint disease from the abnormal posturing will complicate the clinical course.

294a, b Meningitis.
This young German Shorthair Pointer has steroid-responsive meningitis (**294a**). She is showing typical signs of meningismus (stiff and painful neck) and a stilted forelimb gait. Image **294b** shows the dog during recovery.



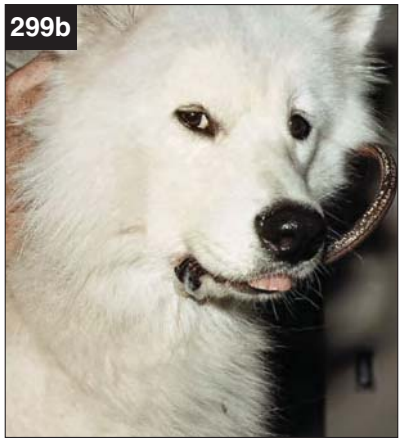
295a, b Brain hemorrhage. Blunt trauma to the head of this dog caused massive subarachnoid hemorrhage throughout the brain. Both the cerebrum and brainstem were affected. Coma and absent cranial nerve reflexes characterized this dog's antemortem clinical findings.

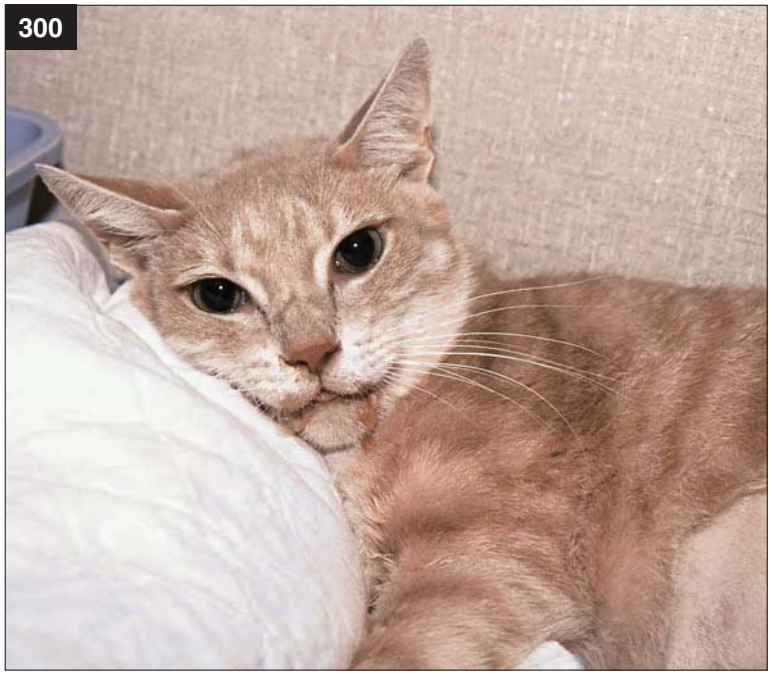
296 Cervical rigidity. This dog is showing classic signs for cervical pain, which can be due to any form of pathology that irritates the dorsal cervical nerve roots or the meninges.

297 Cranial nerve V palsy. This dog was unable to voluntarily close its mouth because it had an idiopathic palsy of the motor branch of the trigeminal nerve. The cause is usually idiopathic and some dogs make a spontaneous recovery. Other differentials for this sign would include temporomandibular joint pathology, bilateral mandibular rami fractures, and rabies.

298a, b Vestibular syndrome: feline. The anxiety displayed by this cat (**298a**) is a result of its vertiginous state due to right-sided vestibular dysfunction caused by a veterinarian's ear cleaning procedure. There is also a mild Horner's syndrome involving the right side, as evidenced by the narrower pupil (**298b**). This resulted from an insult to the sympathetic nerve as it traversed the traumatized right tympanic bulla.

299a–c Cranial nerve VII palsy (Bell's palsy). This Samoyed shows facial muscle asymmetry because of its right-sided cranial nerve VII palsy. Most of these afflictions in the dog are idiopathic and are characterized by weak muscles of facial expression on the involved side. This dog has a right-sided lip droop with drooling and it is unable to retract its orbicularis oris muscle.





300 Uremic encephalopathy. An extreme uremic condition can cause encephalopathy, which is a near terminal sign. It occurs because of an accumulation of uremic toxins consisting of metabolites of proteins and amino acids. This cat was in such a state that seizures could even have occurred. The main clinical sign was dementia.

301a–e Narcolepsy. Narcolepsy is a rare condition characterized by recurrent uncontrollable attacks of sleepiness, often accompanied by temporary cataplexy. Certain stimuli such as eating will trigger these episodes in the dog, as shown in this Airedale Terrier.

11

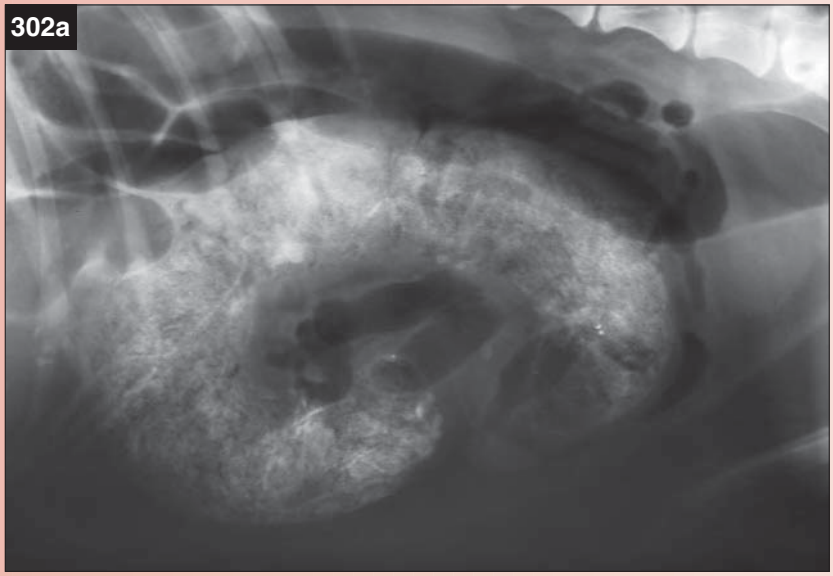
Neoplastic disorders

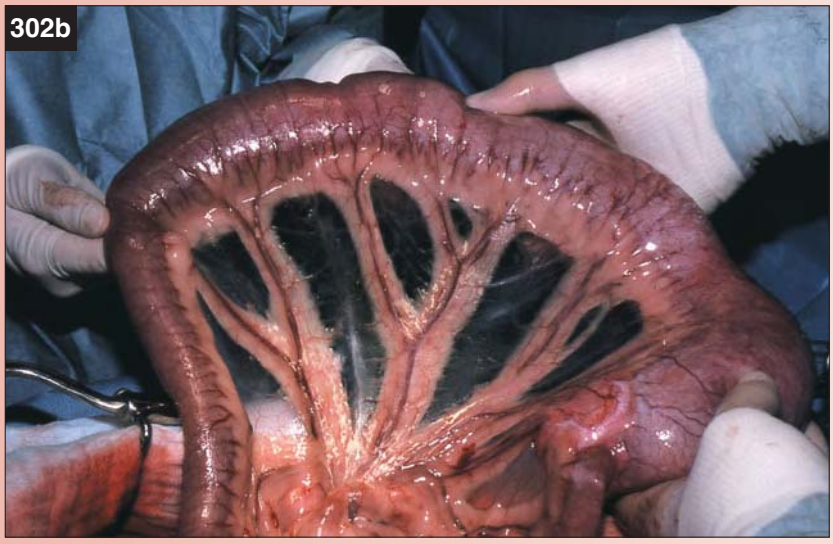
NEOPLASIA comes from the Greek words ***neo***, meaning new, and ***plasis***, meaning molding. Cancer has reached epidemic proportions in human and veterinary medicine and it should come as no surprise that close to 40% of the cases that come into a veterinary referral facility are cancerous disorders. Therefore, it behooves the clinician to know when to biopsy a tissue that might be neoplastic. Cancer can involve any tissue of the body and this, therefore, offers a clinician the opportunity to observe several interesting disorders. The two main diagnostic modalities are imaging and biopsy, but it is still essential to evaluate the entire patient in order to appreciate the full scope of the disease at hand. Many of the lesions illustrated will be available to visualization and palpation, thus making a thorough physical examination an essential part of the diagnostic evaluation.

◀ Squamous cell carcinoma (tongue).

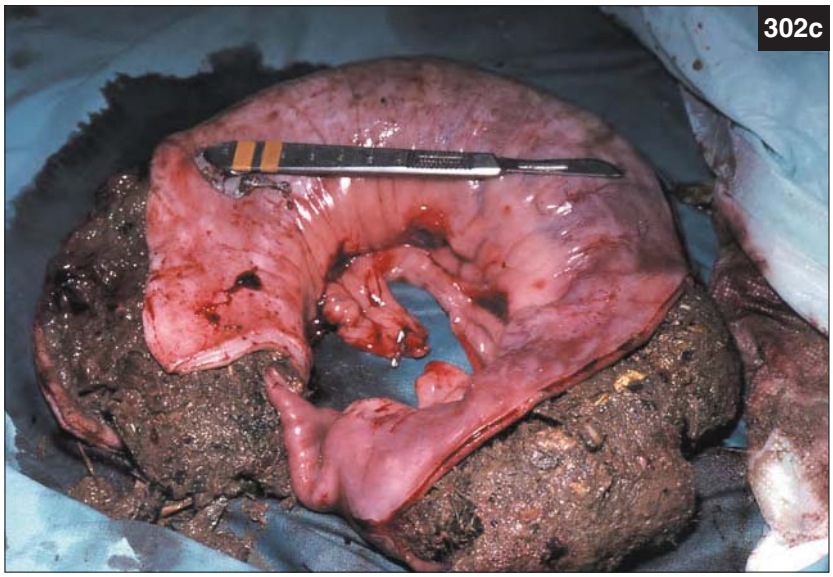
Neoplastic disorders

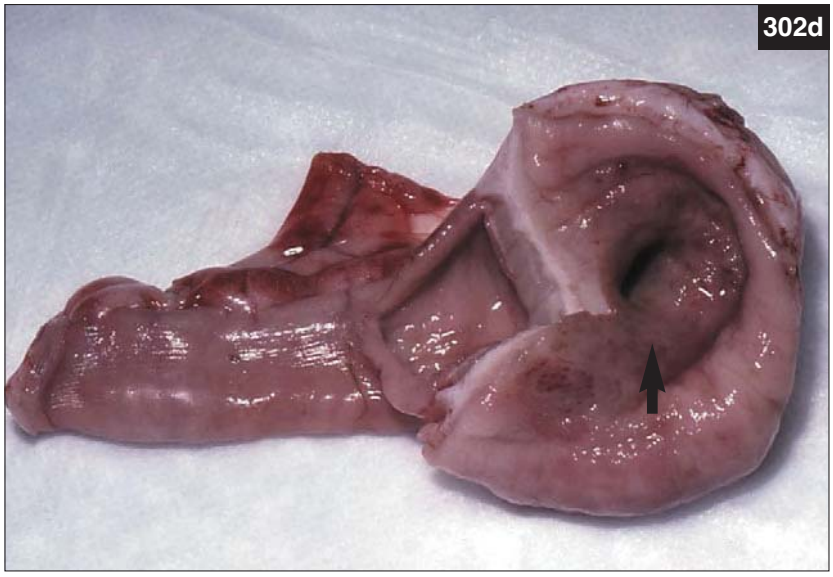
- Cutaneous mast cell tumors can mimic any type of skin growth.
- Assume any firm mammary nodule as carcinoma until proven otherwise.
- Mammary tumors – don't stick it, cut it.
- Don't miss lymphangitic inflammatory mammary carcinoma.
- Nasal disease can do anything.
- Copious mucoid nasal discharge – think nasal adenocarcinoma.
- Try gastric biopsy forceps for nasal biopsy.
- Closed mouth nasal cavity radiographs are useless.
- Cancer can cause elevated total WBCs and fever.





302a–e Intestinal carcinoma.
The annular carcinoma located at the ileocecal region in this dog caused stool to accumulate proximal to the site of obstruction, resulting in the dog becoming severely obstipated. Surgical resection and anastomosis was necessary to relieve the dog of his discomfort. Shown is the lateral radiograph (**302a**), the intact and resected intestine (**302b, c**), and the dissected segment of the excised ileum proximal to the obstruction (arrow) (**302d**). The dog had vomited a feculent liquid material on 1–2 occasions (**302e**).


302c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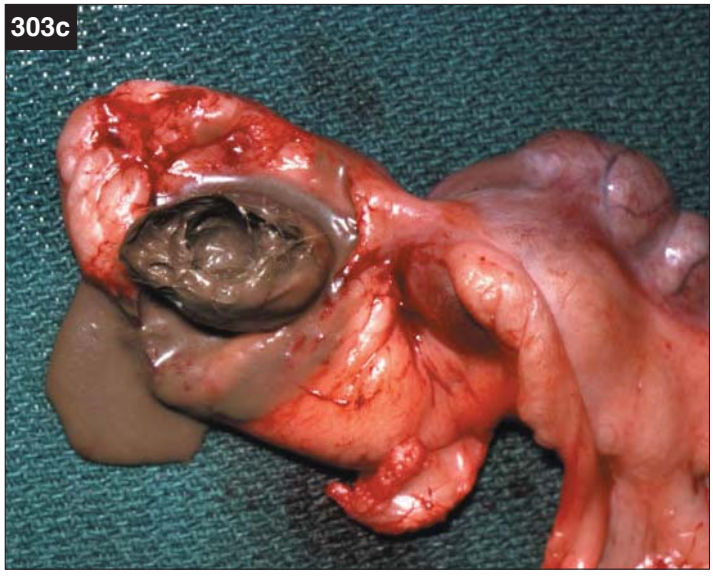
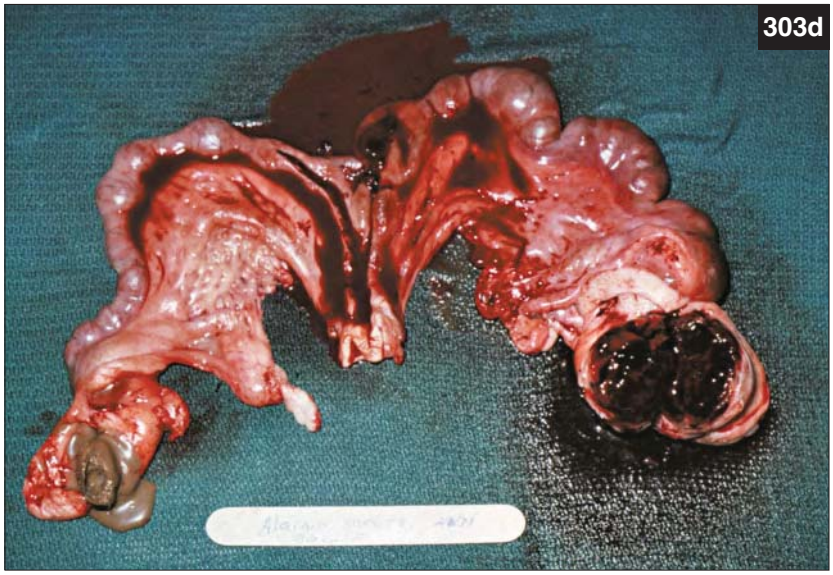
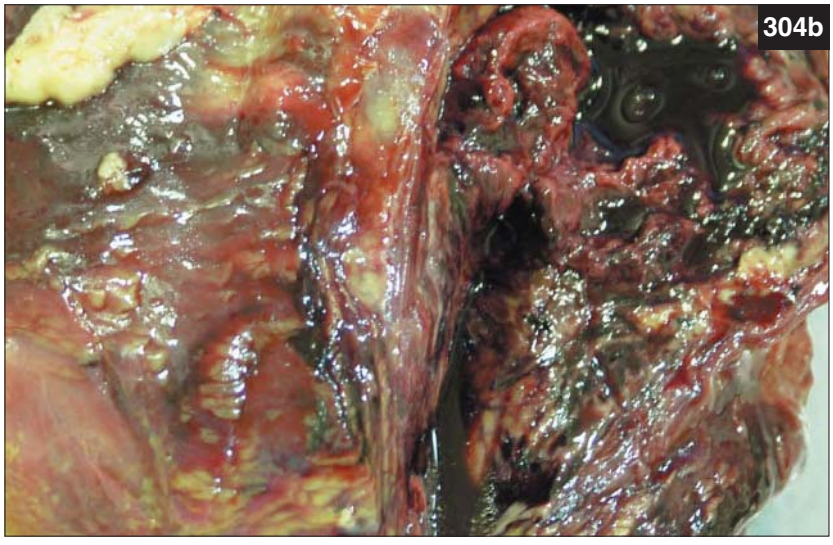


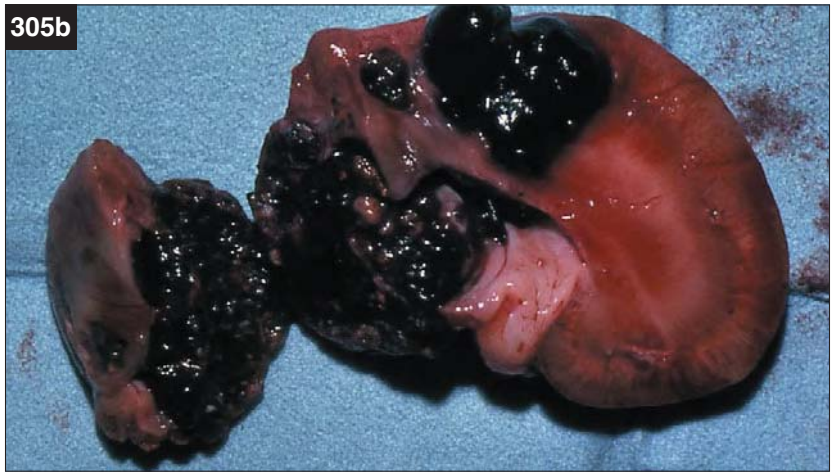
303a–d Dermoid cyst and thecal cell tumor. This female Boxer presented with signs of pyometra and obvious hyperestrinism. Note her prominent nipples (**303a**), and the vulvar edema and caudal skin hyperpigmentation (**303b**). The surgical findings included an ovarian teratoma (**303c**) and an ovarian granulosa cell tumor and suppurative metritis (**303d**). The uterus was dissected for demonstration purposes. Same figures as seen in case **234**.


303d

304a, b Telangiectatic osteosarcoma.
This mixed breed dog had a 3–4 week history of progressive lameness followed by a sudden onset of swelling (**304a**). What was thought to be a skeletal muscle hemangiosarcoma was actually a telangiectatic osteosarcoma (**304b**).


304a

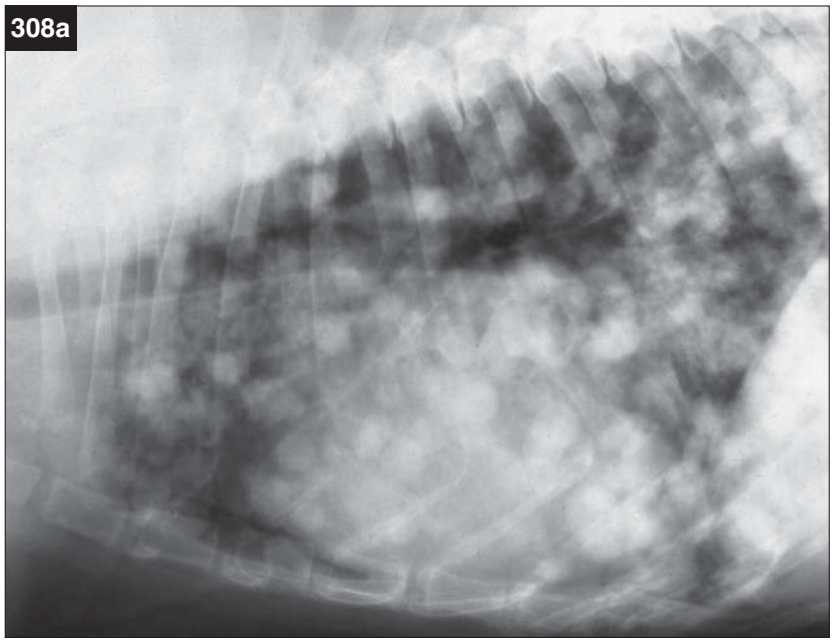

304b



305a, b Hemangioma.
If it were not for snow on the ground, the hematuria caused by this bleeding renal hemangioma in a Corgi might not have been detected by the owner. An intravenous pyelogram was done prior to nephrectomy to be sure that the remaining kidney appeared normal.

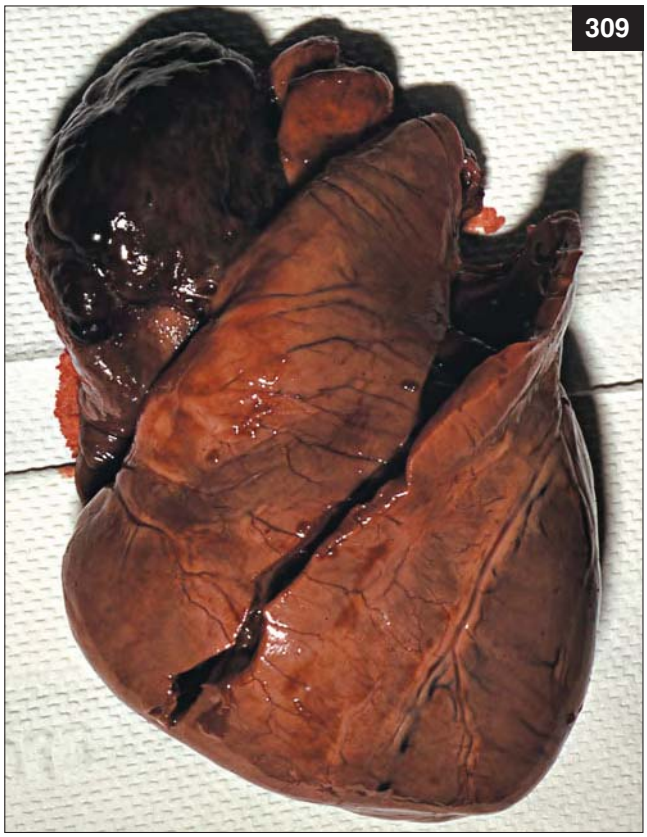
306a, b Cutaneous hemangiosarcoma.
What was initially thought to be a spider bite lesion in this cat was actually a cutaneous hemangiosarcoma, which was confirmed with a skin biopsy. The initial lesions appeared as bruises (**306a**), but the cancer defined itself better with time (**306b**). Cutaneous hemangiosarcoma can sometimes cause DIC. With a widespread pattern of distribution, the prognosis is grave because of metastatic disease.

307a, b Cutaneous hemangiosarcoma.
This cat also has cutaneous hemangiosarcoma. Instead of the bruising effect as seen in the previous case, this cat has what appears to be petechiae and ecchymoses. A simple skin biopsy can diagnose this disorder. The prognosis is grave when the tumor is spread out in this manner.

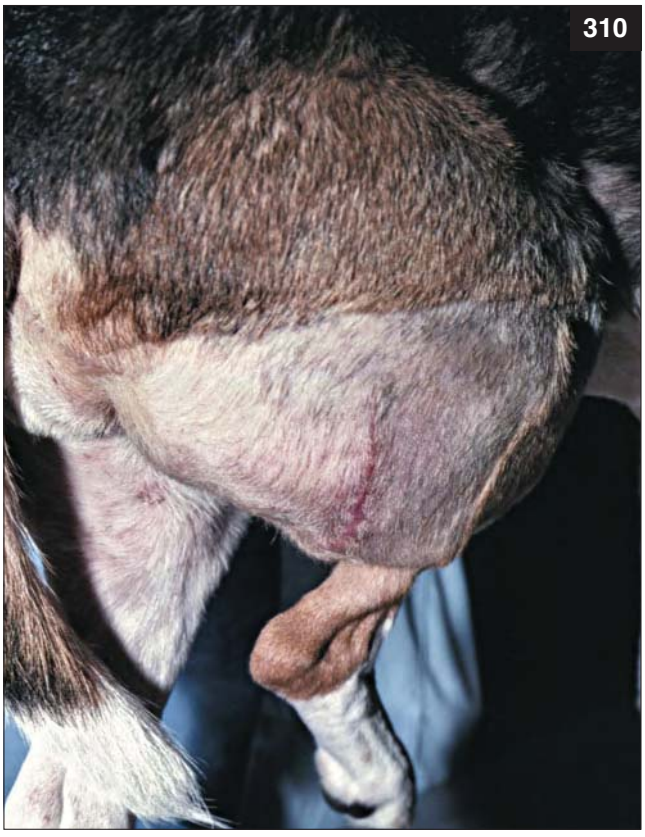


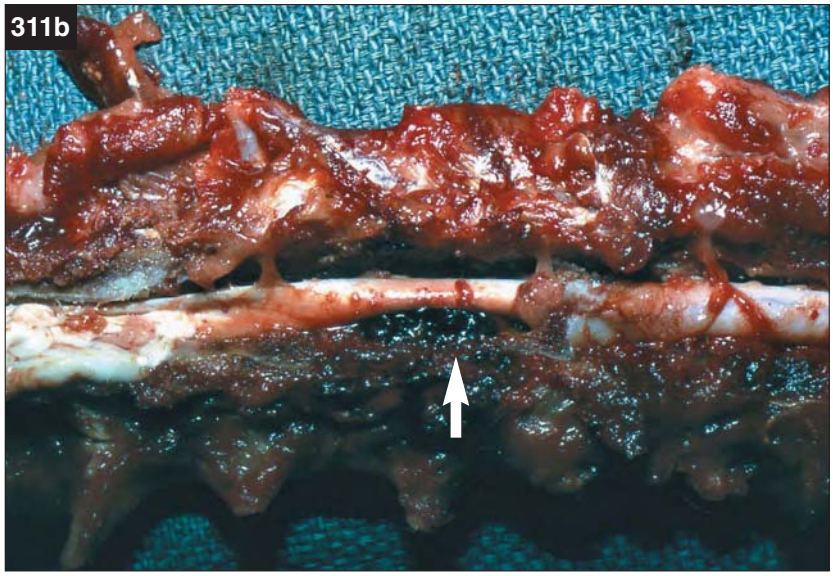
308a, b Hemangiosarcoma: pulmonary metastasis.
The lungs are a common site of metastasis. A diffuse type of dissemination is common for hemangiosarcomas, as shown in this radiograph (**308a**). The lesions are typically dark red and cavitated (**308b**).

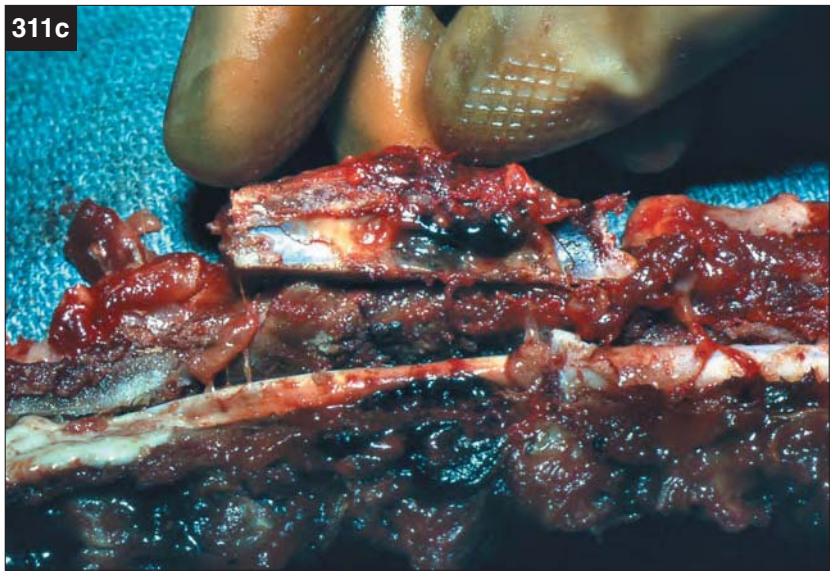
309 Hemangiosarcoma: right atrium.
Right atrial hemangiosarcoma can cause signs associated with pericardial effusion, cardiac arrhythmias, and/or pulmonary metastasis. Although some of these tumors can be surgically resected, the prognosis is still grave.



310 Hemangiosarcoma: thigh muscles.
This Beagle's right hindlimb had a sudden onset of swelling from the bleeding that resulted from a hemangiosarcoma originating in its right thigh muscles. The dog's history is typical for this particular tumor in this particular location. Fine needle aspiration is typically bloody and representative sarcoma cells might not be recognized. The surgeon will often mistake the hemangiomatous muscles as blood clots. Both DIC and metastasis are common complications.

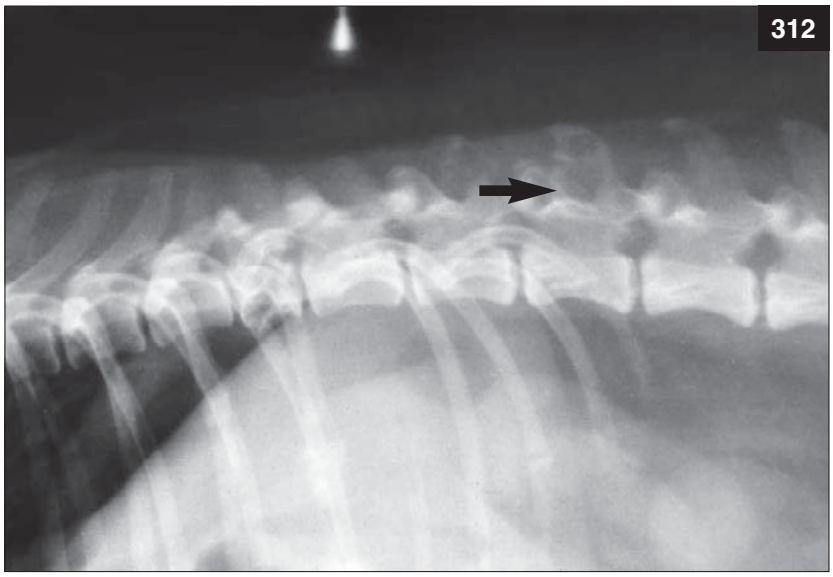




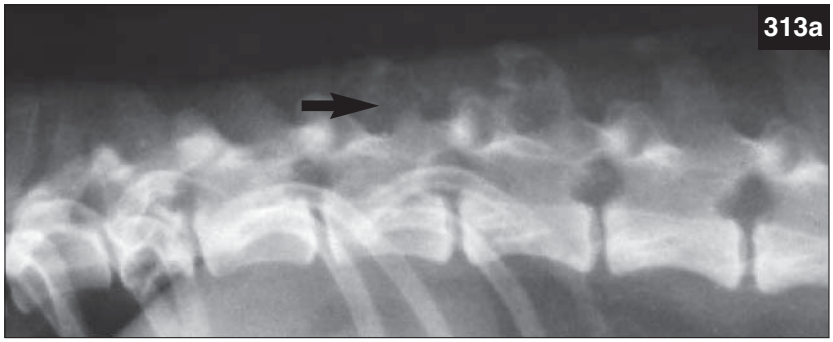


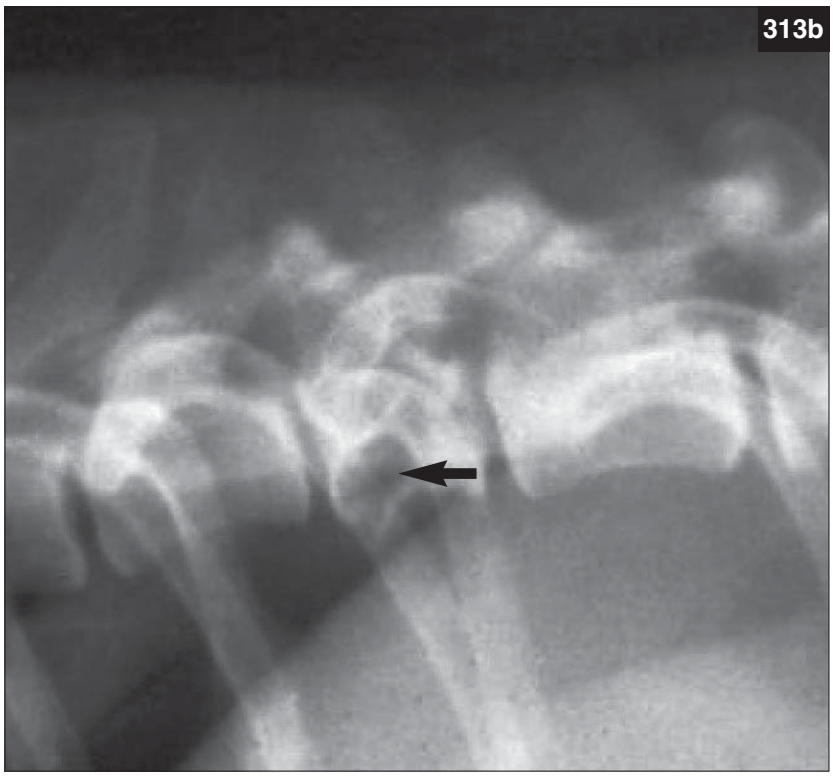
311a–c Hemangiosarcoma: vertebral.
The epaxial muscle was the primary origin of this hemangiosarcoma (**311a**). It eventually invaded the vertebra and the spinal canal (**311b, c**), which caused acute paralysis, pain, and Schiff-Sherrington posture (see also **286a, b**).

312 Multiple myeloma.
This lateral radiograph shows typical multifocal osteolytic lesions in the thoracic and lumbar vertebrae (arrow), strongly suggestive of multiple myeloma. This was diagnosed definitively on histopathologic examination. The patient had a sudden onset of pain and collapse. Note the collapsed T12 vertebra.



313a, b Multiple myeloma.
Close-up views of the dog in **312** showing the clean punched out lesions of multiple myeloma and the collapsed T12 vertebra (arrows).



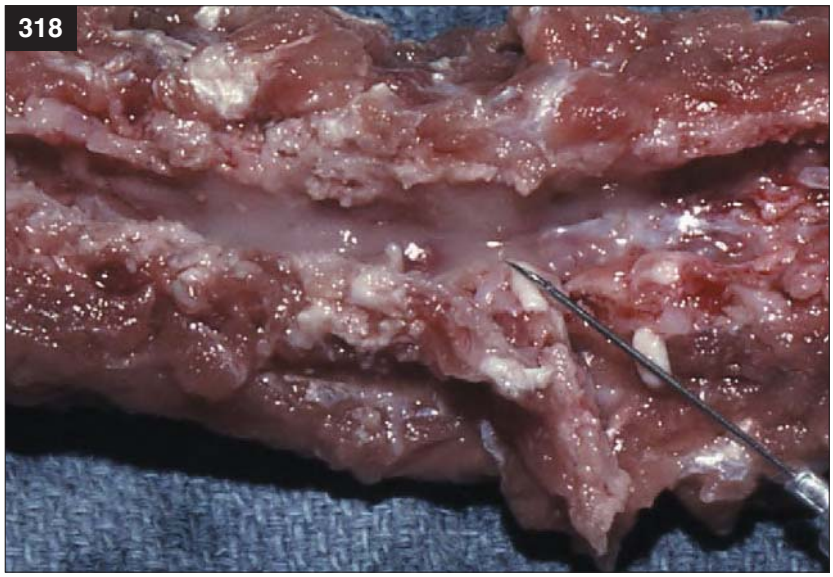


314 Inflammatory mammary carcinoma.
The next four images illustrate different forms of mammary inflammatory carcinoma, a highly malignant form of mammary cancer in the dog. This first image is from a white Scottish Terrier in which the lesion was initially mistakenly diagnosed as contact dermatitis involving the ventral abdomen. It was referred because it had not responded to glucocorticoid treatment.

315a, b Inflammatory mammary carcinoma.
These last two images show a superficial ulcerative form of inflammatory mammary carcinoma in a Welsh Corgi. This lesion will spread rapidly to involve the perineum as well as the inner thighs. Metastasis occurs early.

316 Inflammatory mammary carcinoma. This image shows inflammatory mammary carcinoma in a Doberman Pinscher. Her mammary glands were very enlarged and inflamed. She was neither postpaturient nor in pseudocyesis to warrant a diagnosis of mastitis. The diagnosis of malignant neoplasia was made with a cytology specimen obtained by fine needle aspiration.

317a, b Inflammatory mammary carcinoma. This dog (**317a**) presented with signs similar to septic mastitis, but it turned out to be severe inflammatory mammary carcinoma. She was febrile and had a leukocytosis of approximately 60,000/ml. The second dog (**317b**) is a Shelty with the same disease, but this particular type is more hemorrhagic, most likely due to tumor-induced vascularization.

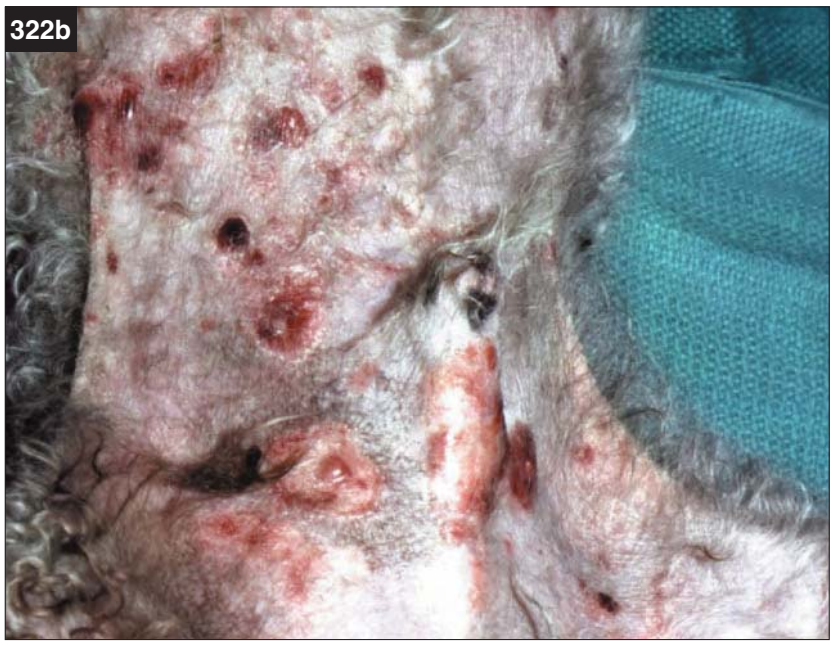


318 Lymphoma: spinal canal. This particular patient had an FeLV-positive anemia. The disease then progressed to involve its nervous system. The gelatinous nature of this particular lymphoma can easily be missed by a surgeon unfamiliar with this syndrome. Radicular pain would likely precede any form of paraparesis with this particular lesion if it originated in the spinal canal as an extradural lesion.

319a, b Cutaneous lymphoma. Cutaneous lymphoma has caused severe facial and truncal disfigurement in this dog. It can easily be diagnosed with fine needle aspiration and cytology. This dog had been to see a number of veterinarians over a several month period, with no diagnostic tests being done.

320a, b Cutaneous lymphoma.
Image **320a** shows a flat and ulcerative form of cutaneous lymphoma in a Collie. Image **320b** depicts nodular and ulcerative cutaneous lymphoma on the dorsal shoulder region in a Poodle.

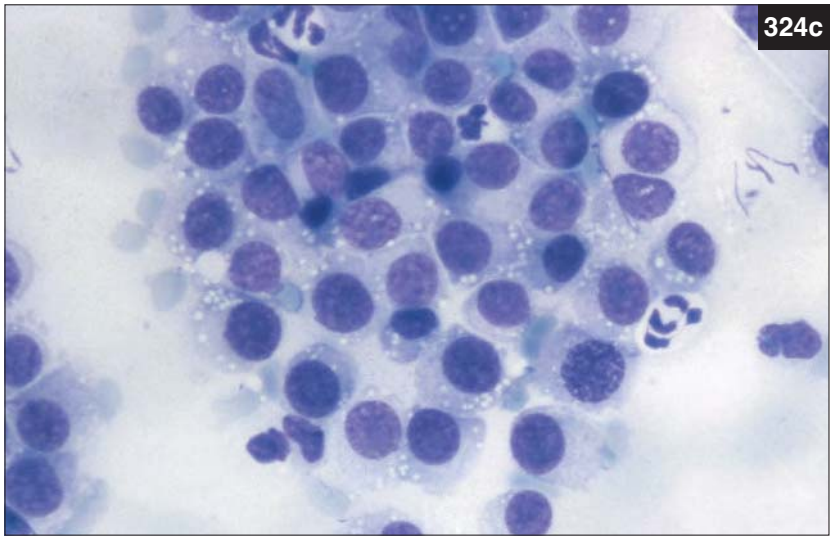
321 Lymphosarcoma.
Massive generalized lymphadenopathy, as seen in this Beagle, should always include lymphoma in the differential diagnosis. Lymphoma is usually easily diagnosed with fine needle aspiration and cytology. The sample is best collected by placing a needle into the lesion and twisting and redirecting it. Then remove the needle, attach it to a syringe containing 3 ml of air, and empty the syringe contents onto a slide by pushing the plunger.



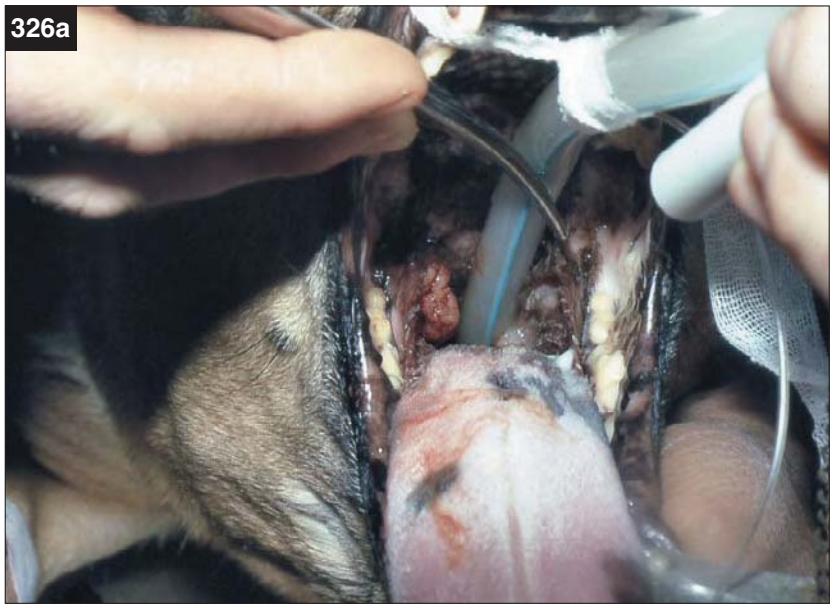
322a, b Cutaneous lymphoma.
The Poodle in **322a** only had a few focal nodular lesions, while the Poodle in **322b** had multiple ulcerative nodular disease. These different examples emphasize the need for skin biopsy in order to make a definitive diagnosis.

323 Lymphangiosarcoma.
The ventral view of this 18-month-old Weimeraner shows the pronounced vascular pattern of lymphangiosarcoma. Some dogs will have regional lymphedema.

324a–c Canine transmissible venereal tumor.
This is the only transmissible neoplasm in the dog (**324a, b**). There is a higher incidence in dogs that are allowed to roam. Transmissible venereal tumors are round cell tumors with a distinctive cytologic appearance (**324c**). They are very responsive to vincristine treatment. Clinical cure is possible if treatment is commenced early enough.



325a, b Squamous cell carcinoma: tongue. When compared with an eosinophilic granuloma, which usually has sharply defined margins when involving the tongue, squamous cell carcinomas are characteristically infiltrative, as seen in these images.

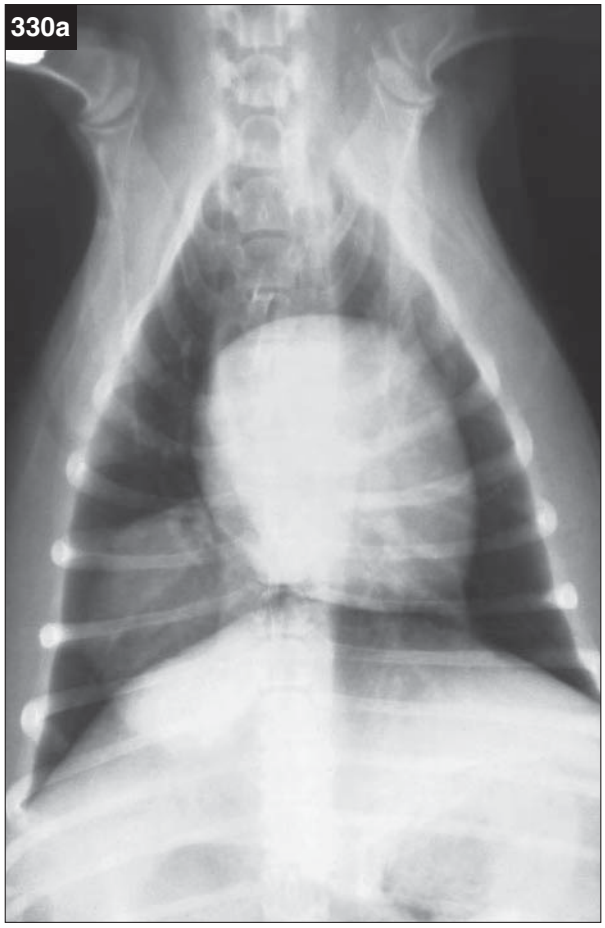


326a, b Squamous cell carcinoma: tonsillar. This German Shepherd Dog presented with signs of gagging and exaggerated swallowing. Squamous cell carcinoma tumor tends to metastasize to the deep cervical lymph nodes.

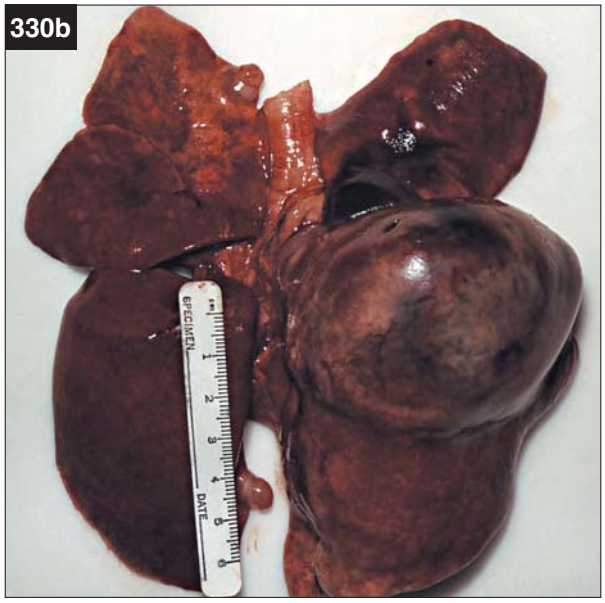
327 Squamous cell carcinoma.
The facial disfigurement in this domestic shorthair cat is caused by advanced squamous cell carcinoma. The cat was still able to eat, albeit messily.

328 Anterior vena cava syndrome.
This dog had lymphomatous involvement in its anterior mediastinum, causing lymphatic obstruction of the head lymphatic vessels and lymphedema to form in its head and neck regions. The enlarged prescapular lymph node is obvious.

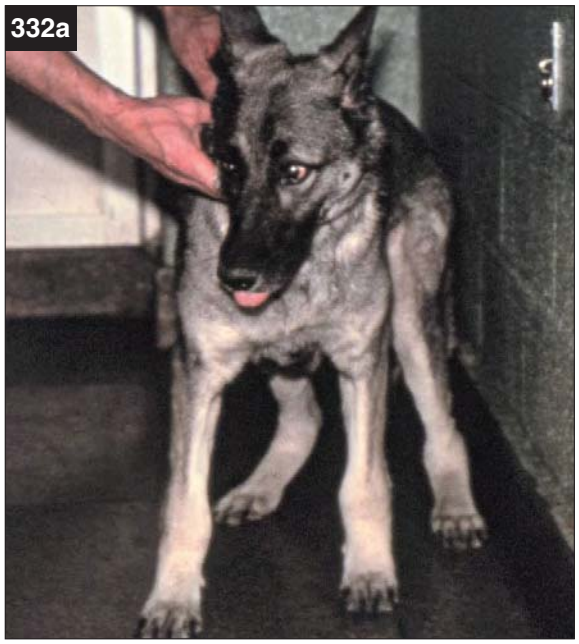
329 Anal sac carcinoma.
This Dalmation has a firm swelling at the 4 o'clock position in the para-anal region. This was caused by an anal sac carcinoma. Anal sac carcinoma is the second most common cause of hypercalcemia of malignancy in the dog.

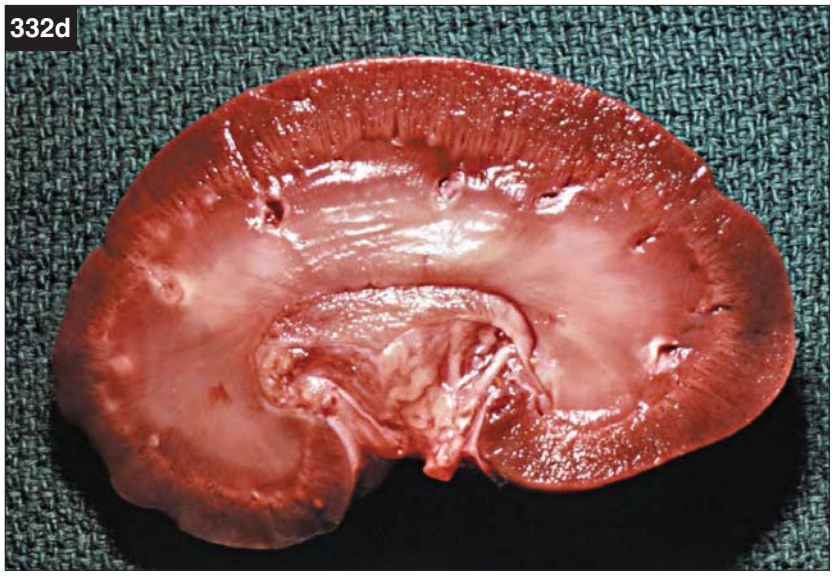


330a–c Lung carcinoma. The right caudal lung lobe is a common primary site of pulmonary carcinoma in the dog. Masses attaining this size will probably have had ample opportunity to metastasize, as seen in this patient. Surgical resection and chemotherapy might provide several months of life.

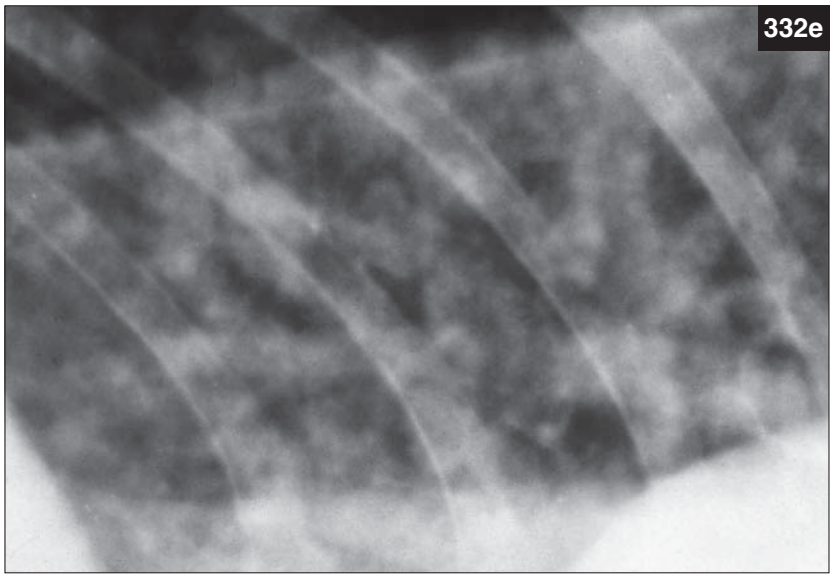


331a, b Lung carcinoma emboli.
The bilateral, distal hindlimb neoplastic lesions in this cat were caused by a primary lung carcinoma that dislodged tumor emboli into the circulation; they subsequently lodged in the end arteries of both limbs. This is a rare clinical condition that has been reported in the veterinary literature.

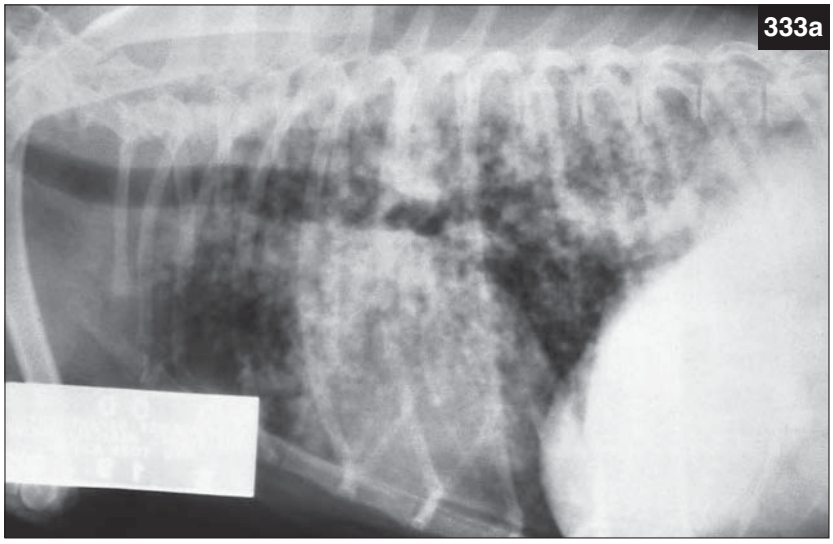


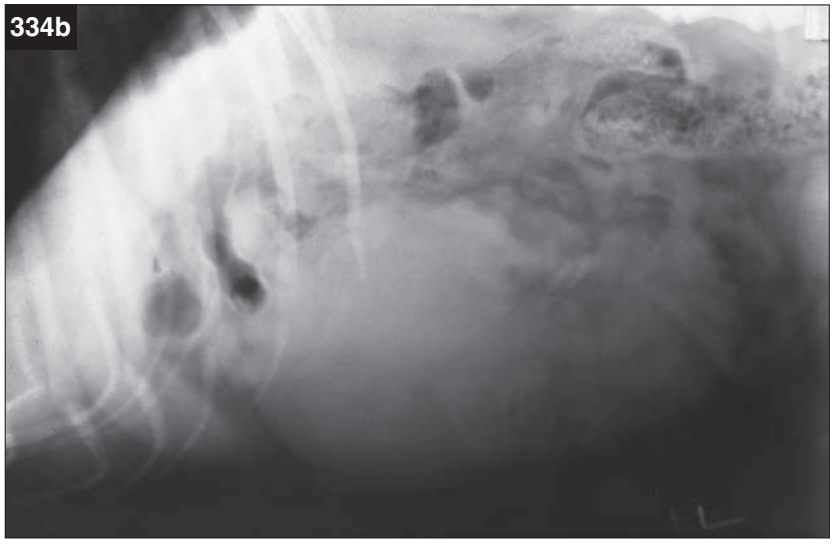


332a–e Hypertrophic osteopathy. This German Shepherd Dog (**332a**) had gross discomfort extending proximally from its inflamed distal appendages. Note the symmetrical swelling involving all four distal appendages (**332b**) and the radiographic demonstration of periosteal proliferation (arrow) characteristic of hypertrophic osteopathy (**332c**). This was caused by a renal pelvis carcinoma (**332d**) that had metastasized to the thorax (**332e**).



333a, b Pulmonary alveolar carcinoma.
This insidious cancer will cause weight loss and progressive pulmonary insufficiency. The diagnosis is suspected based on history and radiography, but a tissue biopsy is necessary to confirm the diagnosis. A fine needle aspiration for cytologic examination might provide strong circumstantial evidence when biopsy is not possible.



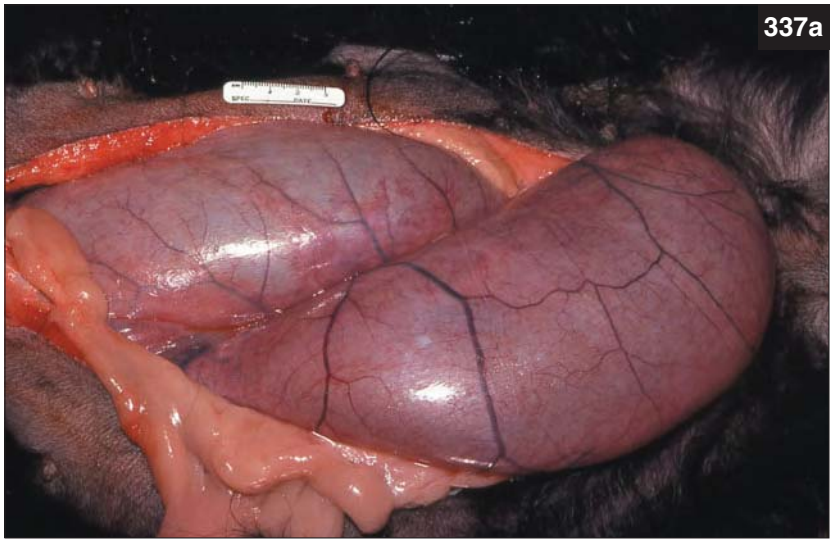


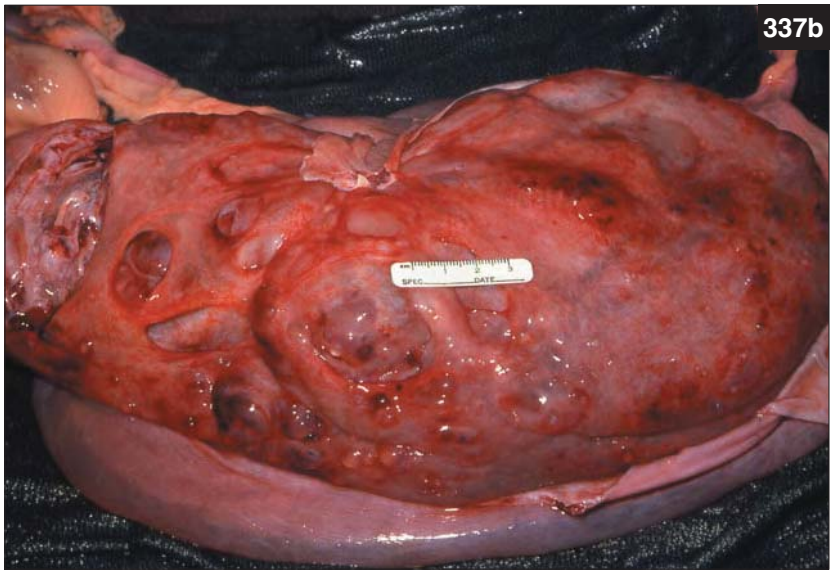
334a, b Sertoli cell tumor. This male German Shepherd Dog (**334a**) shows signs of feminization from the retained Sertoli cell testicular tumor seen on the accompanying abdominal radiograph (**334b**). The feminization signs include a redistribution of body fat, skin hyperpigmentation and alopecia involving the posterior thighs and caudal ventral abdomen, and mammary gland thickening. Also described in case **233**.

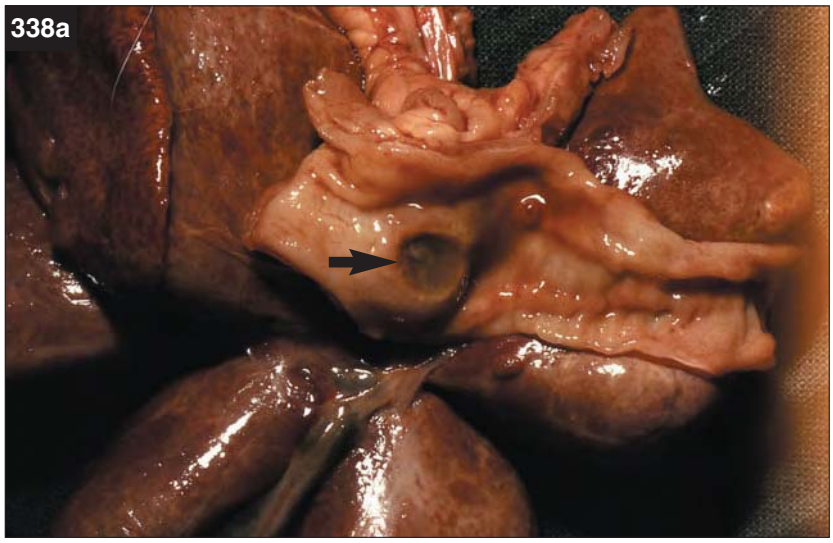
335 Sertoli cell tumor: torsion. The dog in case **334** also had abdominal discomfort because the intraabdominal cryptorchid Sertoli cell tumor was necrotic due to concomitant testicular torsion.

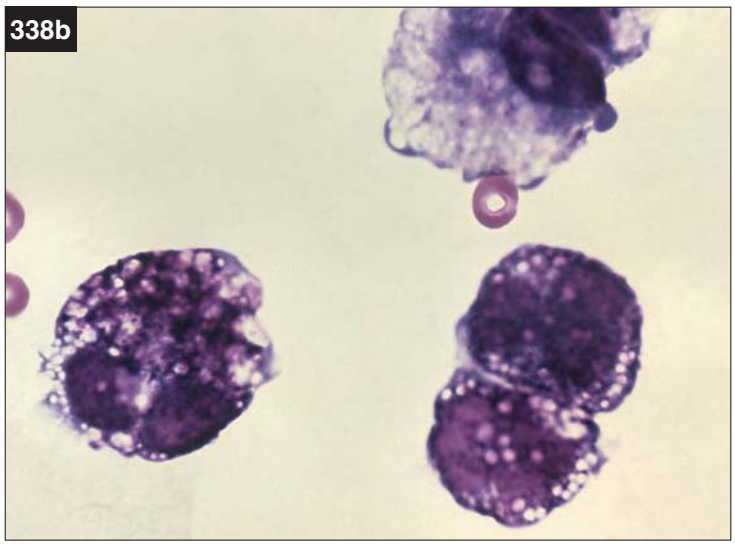
336 Testicular tumor: femininization.
This dog has nipple prominence and a pendulous prepuce due to a scrotal interstitial cell tumor. Feminization occurs with the least frequency with this particular cell type.

337a, b Uterine adenocarcinoma.
Uterine tumors in the dog are rarely seen in countries where ovariohysterectomy is commonly done. These images are of a very large uterine adenocarcinoma involving both horns.

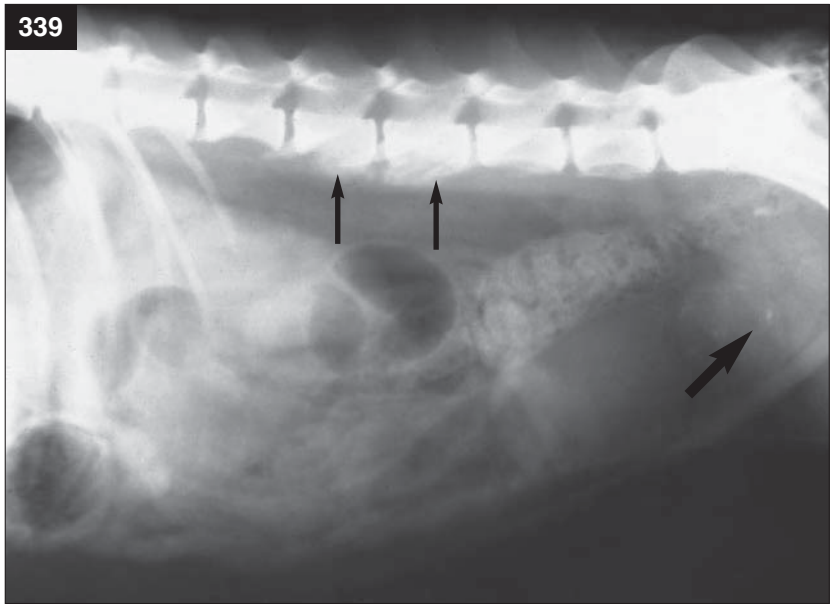






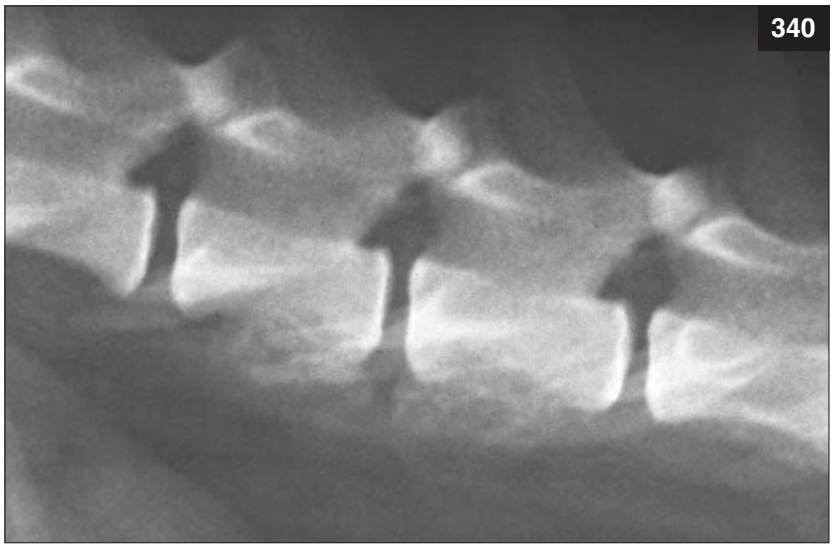


338a, b Mast cell tumor. The tumor from this dog involved liver, spleen, and abdominal lymph nodes (**338a**). The histamine produced from the tumor stimulated gastrin release, which increased stomach acidity and predisposed the dog to developing a duodenal (peptic) ulcer (arrow). Also shown is a photomicrograph of mast cells (**338b**).

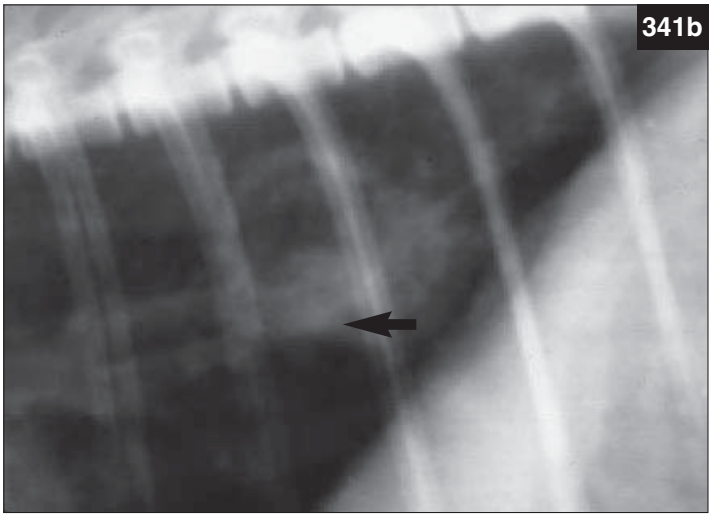


339 Prostatic carcinoma. The enlarged prostate seen in this radiograph is caused by prostatic carcinoma (arrow). The ventral vertebral bodies also have proliferative changes compatible with metastasis to this particular area (arrows). This is shown more clearly in **340**. The tumor cells can be obtained by performing a prostatic-urethral wash technique using a urethral catheter, or they can be obtained with an ultrasound-guided fine needle aspirate biopsy of the prostate.

340 Prostatic carcinoma: metastasis to the spine.
The proliferative lesions on this male dog's caudal lumbar vertebrae are typical for metastatic prostatic carcinoma. The prognosis is grave.



341a, b Renal carcinoma.
This tumor (**341a**) can also have solitary metastatic cavitary lesions that can resemble an abscess (arrow), as seen in this radiograph (**341b**). It can often metastasize to the thorax, with multiple lesions, as seen in case **332e**, p. 239.



12

Toxicologic disorders

(including snake bite envenomation)

TOXICOLOGY is derived from the Latin word ***toxicon***, meaning poison. In small animal veterinary clinical practice, cases will often present as medical emergencies. The diagnosis and medical treatment are often fairly routine when the history provides the knowledge of exposure, but when that information is unavailable, the diagnosis will pose a definite challenge to the clinician. This is why the recognition of the characteristic signs of certain toxins is essential for making a timely and often life saving diagnosis. The images that follow are all from true life cases representing the more common clinical toxicologic disorders. The clinician should also remember the antidotes for the various toxins and have them readily available in the hospital or close-by, where access can be expedient.

The reader will hopefully excuse the author for including snake bite envenomation in this 'picture book', but the nature of my practice in the State of Florida has offered me the opportunity to witness the devastating consequences that can occur when dogs and cats are envenomated by certain species of snakes. Although the examples that follow are due to snakes indigenous to the Southeast United States, there are various other related snakes in other parts of the world that can cause similar pathology. Here again, modern day travel can bring animals from afar to parts of the world where these poisonous snakes prevail, thereby justifying some familiarization with these very interesting disorders.

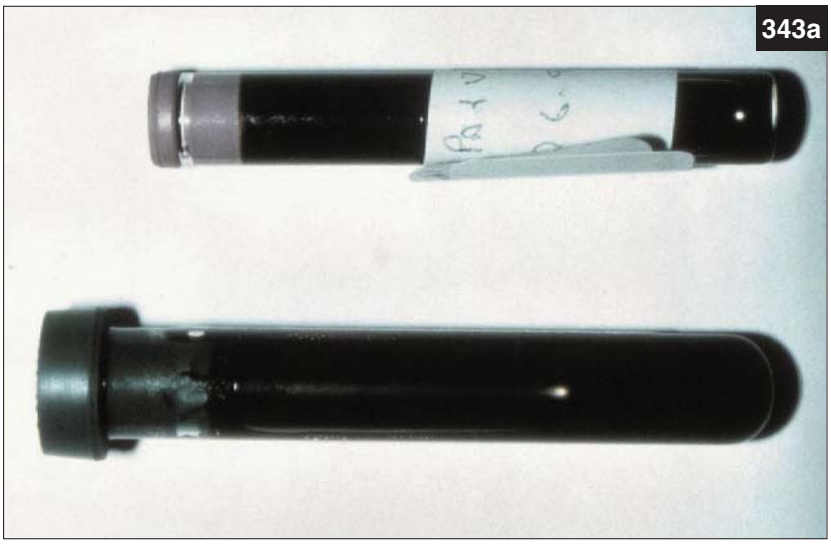
◀ Cyanotic mucous membranes in a cat with acetaminophen intoxication.

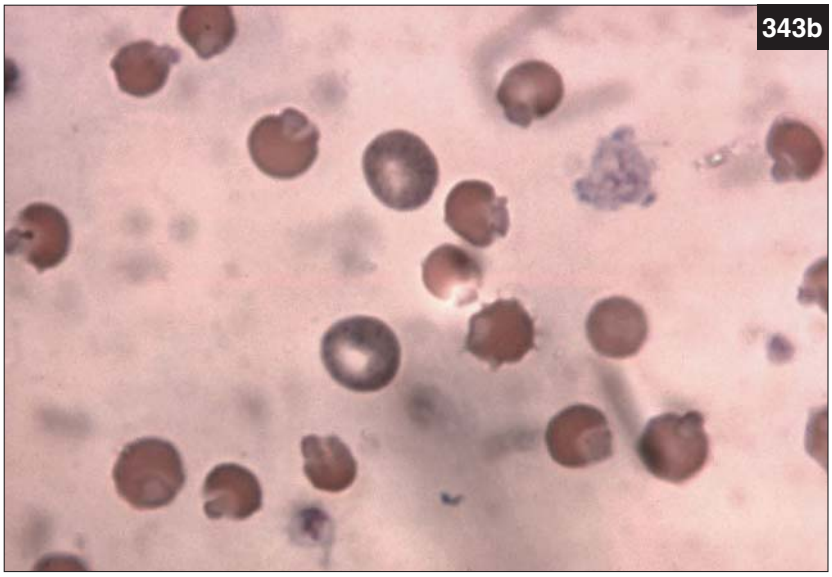
Toxicologic disorders (including snake bite envenomation)

- Ethylene glycol fluoresces.
- Dimercaptosuccinic acid (DMSA, succimer) – a new oral treatment for lead poisoning.
- Unexplainable radiodense particles in the bowel – think lead.
- 4-methylpyrazole 5% for antifreeze intoxication – avoids hangovers.
- Newer anticoagulant rodenticides – treat for 4–6 weeks.
- Newly acquired bleeding – think anticoagulant rodenticide poisoning.

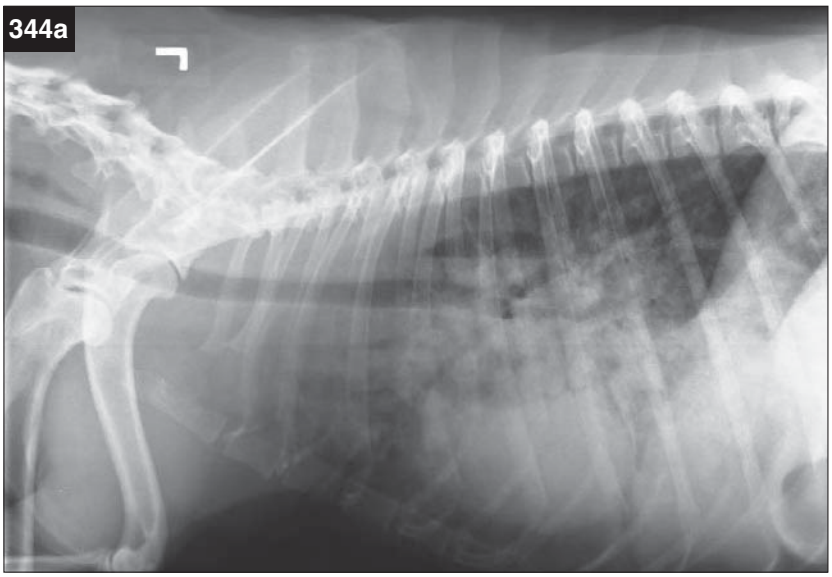
342a–c Acetaminophen intoxication.
The facial edema (**342a**) and cyanotic mucous membranes (**342b, c**) in this cat are the result of acetaminophen intoxication. The edema is most likely due to endothelial space leakage caused by the hypoxemia. This will respond to the antidote acetylcysteine and other supportive treatment such as parenteral fluids, SAMe, milk thistle, vitamin C, and oxygen.

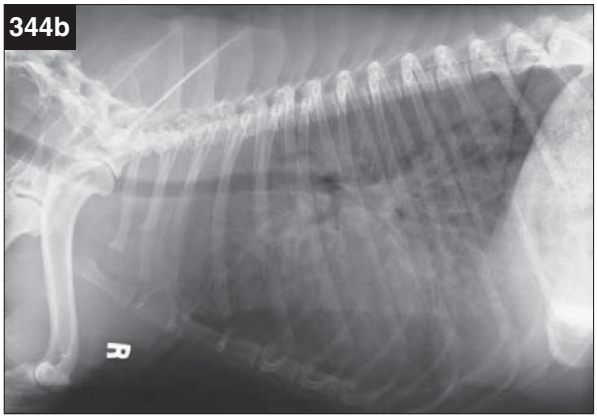
343a–c Acetaminophen intoxication.
Methemoglobinemia is one of the metabolic side-effects of acetaminophen intoxication. This reduced form of hemoglobin is responsible for the 'chocolate-colored blood' (**343a**) and the clinical cyanosis. Methylene blue would ordinarily reverse this effect, but it is contraindicated in the cat because of its ability to worsen the Heinz body hemolytic anemia (**343b**) (also shown in case **122**, p. 103). Instead, ascorbic acid can be given, but with less benefit toward this particular problem. The green urine precipitate (**343c**) is a metabolite of the acetaminophen that accompanied the hemoglobinuria.

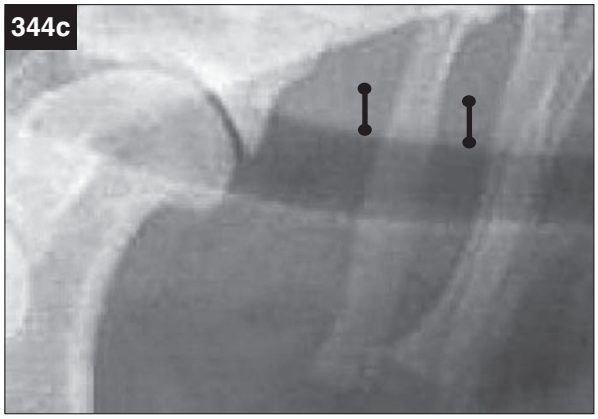

343a


343b


343c



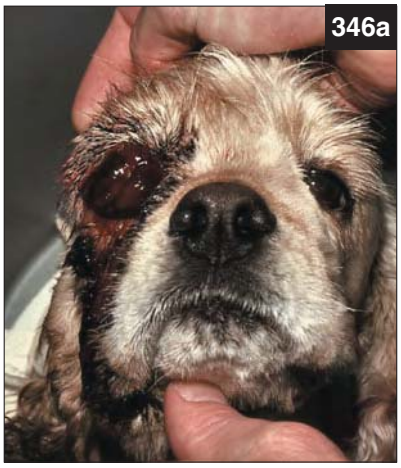




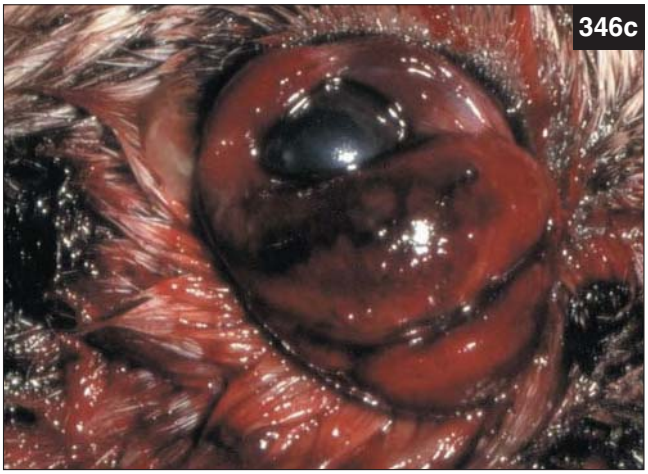
344a–c Anticoagulant rodenticide intoxication. These left lateral (**344a**) and right lateral (**344b**) chest radiographs are from a dog that had ingested an anticoagulant rodenticide. The pulmonary parenchymal infiltrate and pleural effusion are common areas of hemorrhage in dogs with this disorder. A narrowed tracheal lumen caused by bleeding just above the trachealis membrane can be seen (**344c**).

345a, b Anticoagulant rodenticide intoxication. Any dog with an acquired hemorrhagic disorder, as illustrated in this dog with ventral abdominal ecchymoses and bleeding from venipuncture sites on its limb, should be suspect for first or second generation anticoagulant rodenticide intoxication.

346a–c Anticoagulant rodenticide intoxication. The periconjunctival hemorrhage in this Cocker Spaniel was the only site of hemorrhage following its ingestion of warfarin anticoagulant rodenticide. The eyeball itself and its contents were normal.

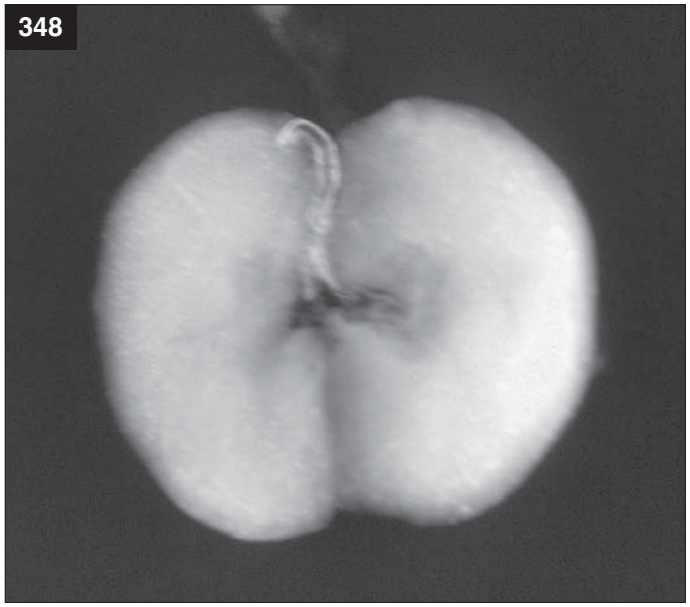

346a


346b


346c

347 Bromethalin rodenticide intoxication. Bromethalin is a rodenticide that inhibits mitochondrial energy production. The clinical signs are neurologic, ranging from weakness to coma caused by the cerebral edema that can ensue within 12-24 hours. This terrier (**5a**) ingested an unknown quantity of bromethalin. The owner's history and their remembering to bring the package containing the poison (**5b**) were very helpful to the clinicians caring for this dog. Its signs never worsened beyond mild weakness following anemetic treatment. Hospitalization for observation and timely treatment is important for this particular intoxicant.


347



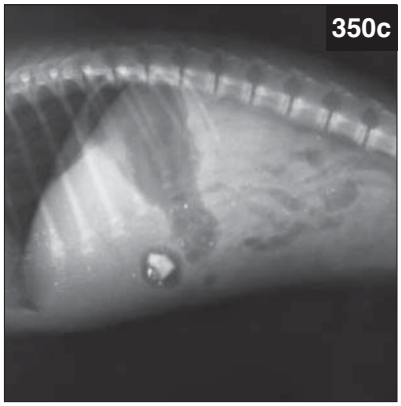
348 Cholecalciferol rodenticide intoxication.
Many rodenticides are easily accessible to the pet owning public, which unfortunately makes these poisons similarly accessible to the dog or cat waiting to ingest them. Cholecalciferol is a rat poison. It works by causing severe hypercalcemia that can go on to cause organ mineralization and subsequent failure. The radiographic image of the kidney shows a damaging degree of nephrocalcinosis. Treatment with calcitonin, glucocorticoids, and intravenous fluids can benefit the cholecalciferol intoxicated patient.

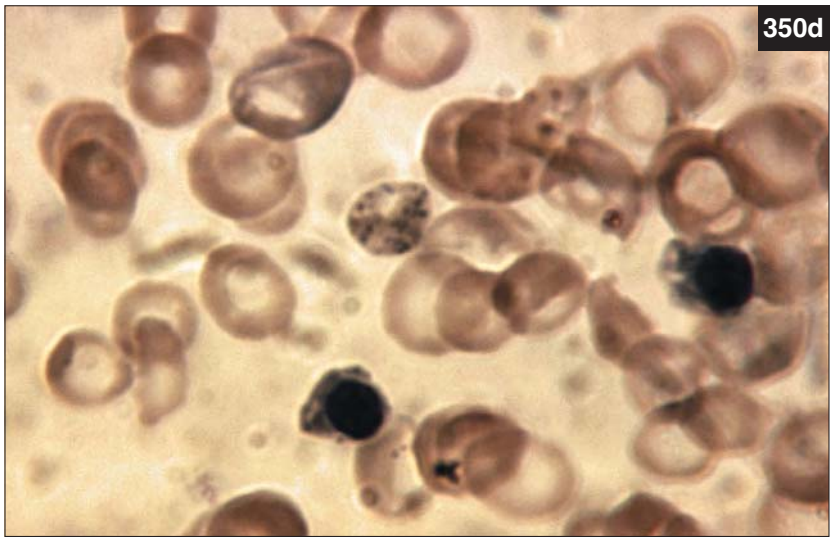
349a, b Lead intoxication.
This 11-year-old neutered male domestic shorthair cat was examined for the primary complaints of mental dullness and decreased activity since its return from New York City, where it had resided during apartment renovations. The possible exposure to lead dust was a cause for suspicion for lead intoxication and a subsequent blood lead measurement was 10x normal. The cat responded to calcium EDTA treatment. The cat, shown in the illustration (**349a**), had very subtle signs, which made the case that much more of a diagnostic challenge. The history was of key importance in this instance because environments, such as the one shown in the picture illustrating the peeling paint (**349b**), can be a major source of intoxication.

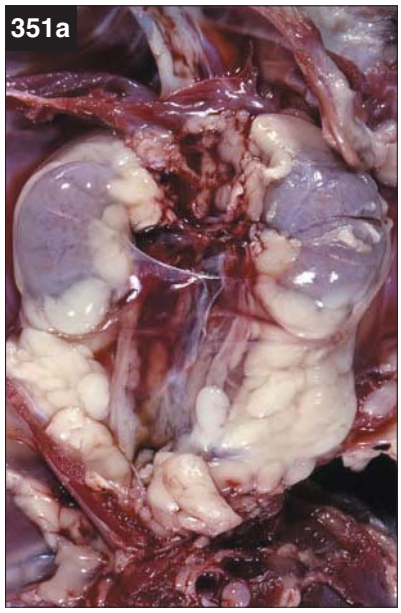
350a–d Lead intoxication. This Poodle puppy acquired lead poisoning from plaster ingestion. Shown is the painful abdominal posturing caused by lead colic (**350a**), 'lead lines' at the growth plates (**350b**), and the lead containing plaster fragments within the stomach (**350c**). The blood smear (**350d**) shows nucleated red blood cells and basophilic stippling (also shown in case **123**, p. 103), which are common hematologic effects of lead poisoning (plumbism). The puppy responded well to calcium EDTA treatment.

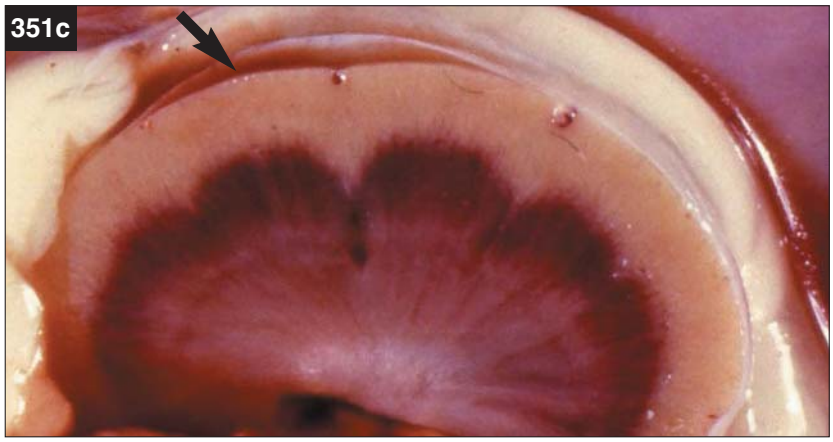

350a


350b

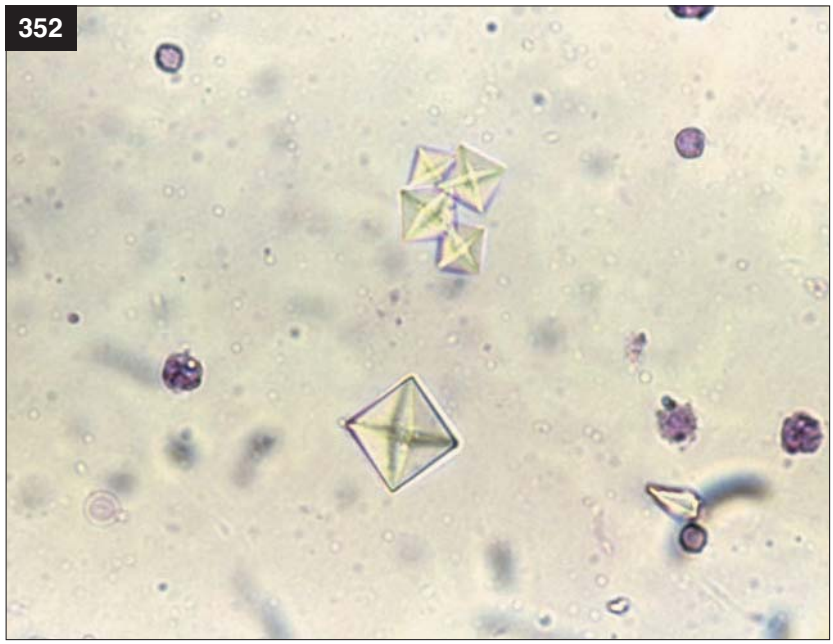

350c


350d



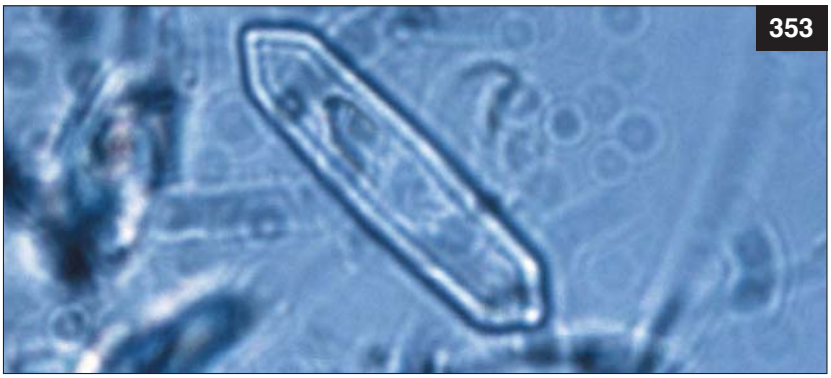


351a–c Ethylene glycol intoxication.
This kidney belonged to a cat that went into progressive renal failure from ethylene glycol intoxication. The kidneys were palpably enlarged because of the subcapsular renal edema associated with acute renal failure (arrows). The urine specific gravity was isosthenuric and the renal failure was progressive.

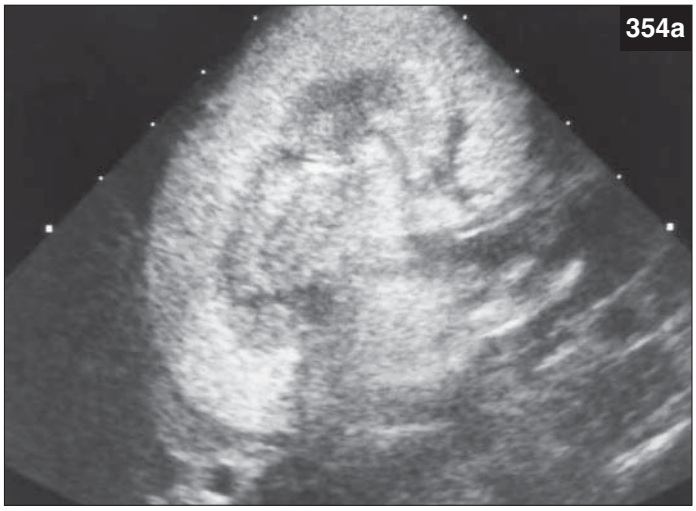


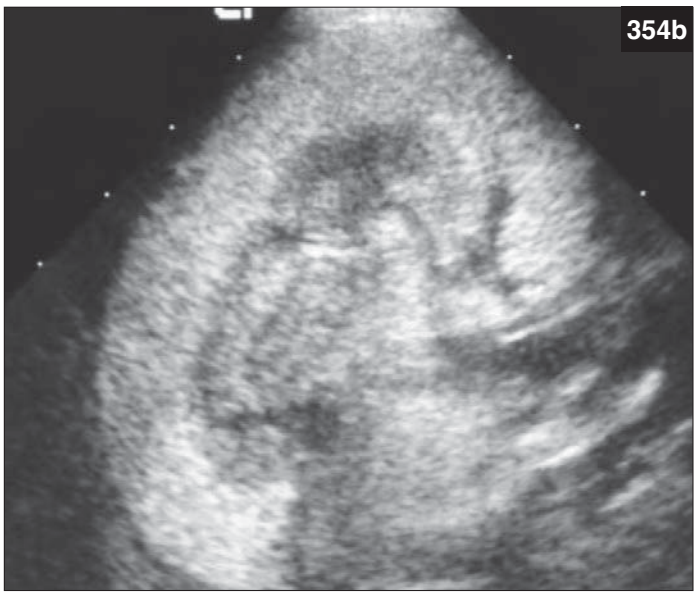
352 Ethylene glycol intoxication.
Oxalate crystalluria is a metabolic by-product after ethylene glycol is ingested and metabolized by the liver enzyme alcohol dehydrogenase. A dihydrate crystal resembling an envelope or a Maltese cross in shape is shown. The crystals are harmful to the renal tubules. The prognosis for recovery is guarded to grave.

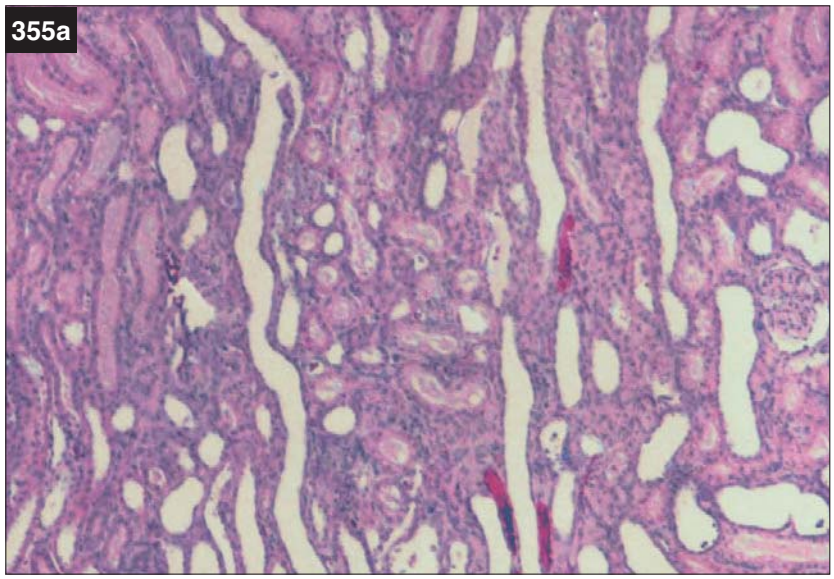
353 Ethylene glycol intoxication.
Monohydrate crystalluria also occurs from ingested ethylene glycol. These crystals have a tombstone-like appearance. Both monohydrate and dehydrate crystals can be found in some cases of ethylene glycol intoxication.

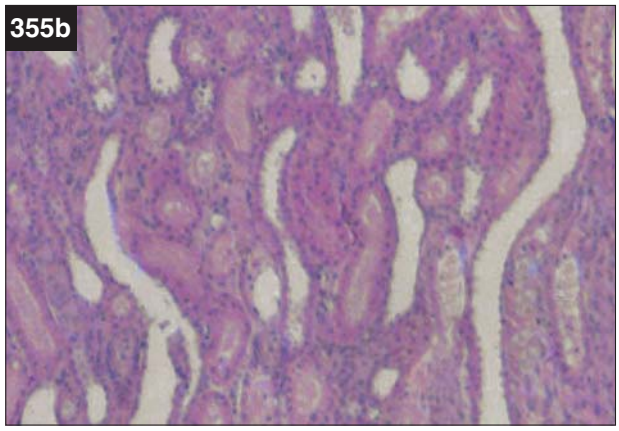


354a, b Ethylene glycol intoxication.
Enough oxalate crystals can accumulate in the renal tubules to cause ultrasound hyperechgogenicity, while the pathophysiologic state is one of acute renal failure with a very guarded to grave prognosis.









355a, b Ethylene glycol intoxication.
Unfortunately, most untreated or delayed treated patients will die from acute renal failure and metabolic acidosis. These histopathologic images show oxalate crystals in the tubules and the accompanying pathologic effects on the renal tubules, which included basement membrane necrosis of the tubular epithelium, seen better in the close-up image (**355b**).

356a–c Black widow spider envenomation.
This cat presented with a sudden onset of exquisite pain, especially on its abdomen (**356a, b**). It had been lying on the porch where the owner professed to seeing various spiders, including a black widow. Based on the signs, including a focal suspect bite wound on the ventral abdomen, and history, ***Lactrodectus mactans*** antivenin was administered intravenously. The cat was normal within a few hours (**356c**).

357a, b Coral snake bite wound site.
The dark bleb on the inner aspect of this dog's right upper lip (**357a**) represents the site of envenomation by an Eastern coral snake. The bite of a coral snake is always small and benign in appearance. It can also appear as small punctuate wounds, as shown (**357b**). Coral snake bite wounds are only evident 50% of the time.


357a

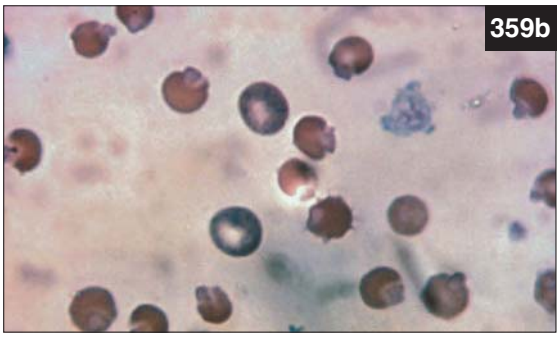

357b

358 Coral snake bite neuropathy.
The bite delivered by an Eastern coral snake to this dog caused a paralysis of the left cranial nerve VII, as shown by the lip droop. Coral snake venom contains a neurotoxin and a hemotoxin, which causes lower motor neuron paralysis and hemolysis in dogs.


358

359a, b Methylene blue hemolysis
(Also shown in Hematology section, case **122**, p. 103). This male Siamese cat was being treated with methylene blue-containing medication for his urinary disorder. Shown are the cat's blue stained mucous membranes (**359a**) and a microscopic image of Heinz body formation on the red blood cells (**359b**) that caused the hemolytic anemia typical of methylene blue intoxication in the cat. It is for these reasons that methylene blue should not be given to cats.


359a


359b

360 Iron intoxication. This Schnauzer ingested a container filled with iron tablets that the owner was using as a supplement. The immediate oral administration of magnesium hydroxide prevented the absorption of the iron from the dog's GI tract, thus sparing it from life-threatening iron toxicosis.

361 Water moccasin (cottonmouth) bite to the paw. This dog's paw was struck by a water moccasin, which is a pit viper with a very harmful venom. The hemorrhagic lymphedema is typical, although the bite site is not. Seventy per cent of the dogs in Florida are bitten in the face in this author's experience. Although the venom from a water mocassin can kill a dog, it is not as potent as the venom from an Eastern diamondback rattlesnake.

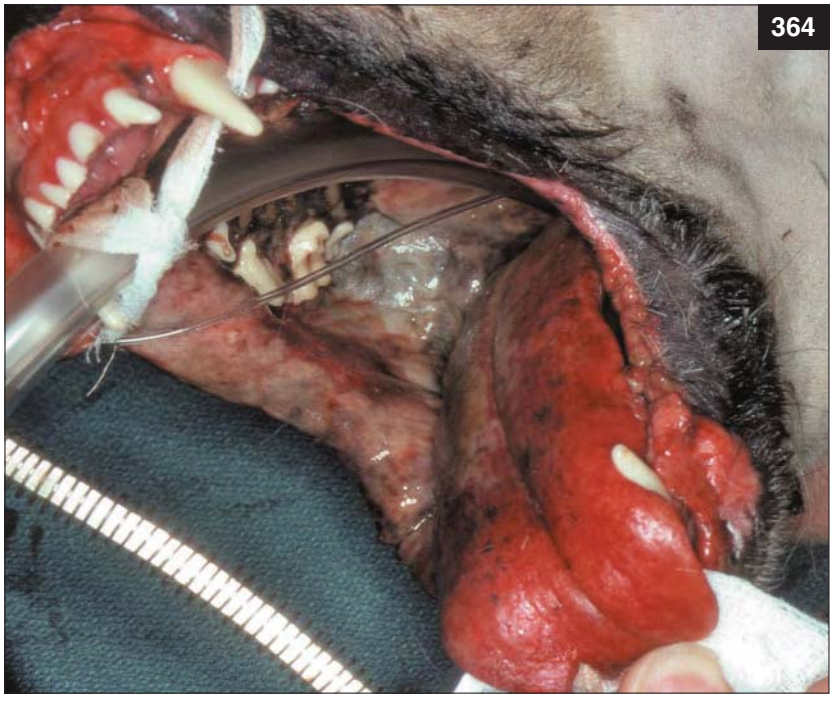
362a, b Organophosphate intoxication. This kitten presented with signs of pronounced neuromuscular weakness characterized by collapse following minimal exercise, as shown in the illustrations. This was caused by exposure to OP insecticides that were deposited as a house spray. This nicotinic sign was the only abnormality present in this patient. There is no specific antidote for this form of OP intoxication. Some sources have recommended the use of diphenhydramine, but the proven scientific basis of this treatment is lacking. Time by itself and removal of the toxic substance from the environment can lead to eventual recovery.

363a, b Organophosphate intoxication.
This puppy was treated for sarcoptic mange with an organophosphate (OP) acaricidal preparation that was supposed to 'be safe' for puppies. However, soon after the diluted solution was applied, the puppy experienced most of the muscurinic signs of organophosphate intoxication including vomiting, hypersalivation, and diarrhea. These were followed by the nicotinic signs of tremors, weakness, and, eventually, generalized seizures. Emergency treatment consisted of bathing the dip residue from the puppy and administering the antidotes atropine sulfate and pralidoxime chloride. Supportive treatment consisted of intravenous fluids and diazepam. Shown is the puppy at the time of admission (**363a**) and after its successful treatment (**363b**).


363a


363b

364 Lye burn.
The severe caustic injury involving the oral cavity mucosa of this German Shepherd Dog was likely caused by lye (sodium hydroxide) that was surreptitiously given to the dog while it was in the owner's back yard. Esophagoscopy and gastroscopy are important evaluation procedures with this type of injury in order to assess any ulcer formation involving the esophagus and stomach. These procedures will also enable insertion of either an esophagostomy or a gastroscopy tube to allow for essential nutritional support.

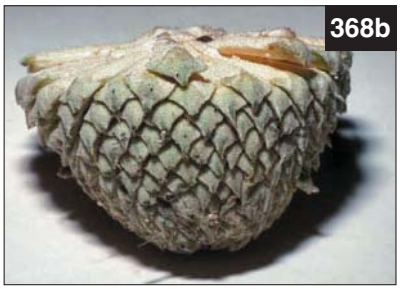

364

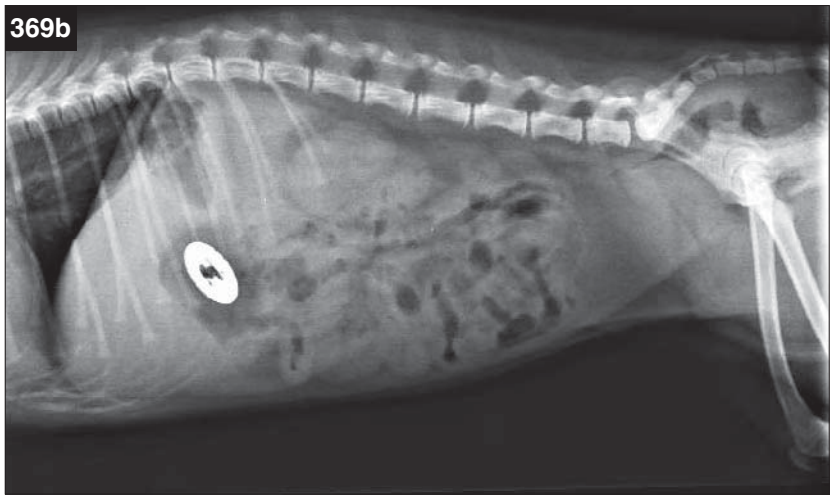
365a, b Rattlesnake bite in a cat.
Most regions of the world have their own indigenous population of venomous snakes and the interesting medical problems that result from envenomation. This Florida cat was bitten on its lateral thorax (common target for the cat) by an Eastern diamondback rattlesnake. Shown is the typical soft tissue hemorrhage (**365a**) and the bite marks that occur (**365b**). Cats are commonly bitten on the lateral and ventral trunk because of the way they spring backward and upward when the snake strikes.

366a Rattlesnake bite to the face.
This Boxer (**366a,**) was envenomated by a 6 foot Eastern diamondback rattlesnake. The systemic hypotension, local hemorrhagic lymphedema, and somnolence are common signs. The bite occurred on the left side of the face and the persistent bleeding is due to the hypofibrinogenolysis that occurs with this particular snake.

367a, b Rattlesnake bite treatment: urticaria.
These images show an urticarial hypersensitivity (type 1) reaction in a Boxer caused by crotalid (pit viper) polyvalent antivenin. It is possible to continue administering antivenin by simultaneously administering epinephrine (0.01 mg/kg IM), using a 25 gauge or smaller needle so as to avoid hematoma formation.

368a–c Cycad poisoning.
The sago palm (**368a, b**) is indigenous to Florida and other parts of the world. In Florida, the seeds found in the fruit can cause severe vomiting and liver necrosis when they are ingested by a dog. Treatment is supportive, consisting of milk thistle, SAMe, nutrition, and parenteral fluids if needed. An affected dog such as the Dachshund in (**368c**) can die from liver failure.

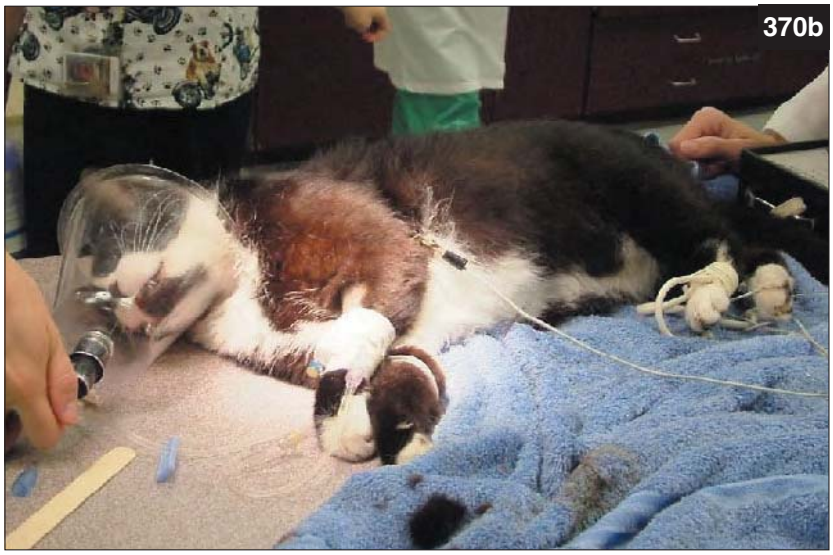




369a–d Zinc intoxication. Metallic zinc intoxication can occur in pets that ingest coins containing this element. Clinical signs in the dog are mainly a hemolytic anemia that will respond following removal of the coin from the GI tract. The Poodle shown (3**69a**) presented for hemolytic anemia and the diagnosis of zinc-induced hemolysis was made after the abdominal radiograph was taken (**369b**). The coin was subsequently removed with gastroscopy (**369c, d**) and the dog recovered uneventfully.

370a–d Permethrin intoxication.
Permethrin insecticides are safe for use in dogs, but they are very toxic to cats and are therefore contraindicated in this species. The kitten shown (**370a**) soon became very mentally depressed and then lapsed into a coma after its exposure to a permethrin based topical insecticide for its fleas. The adult cat (**370b, c**) presented with marked tremors and hyperexcitability soon after the owner's spot application of this compound. Both of these cats responded to supportive treatment (**370d**); no antidote is available.


370a


370b


370c


370d

13

Miscellaneous disorders

I HAVE CONVENIENTLY included several interesting clinical disorders that do not fall within the confines of the other areas listed, such as certain immune disorders and others that are classified as inflammatory, metabolic, or environmental, or, perhaps, just stand as entities unto themselves. These conditions are very interesting from a pathophysiologic point of view, although the exact cause might not be known. Many of these conditions are rare and this is where a picture is indeed worth 1000 words.

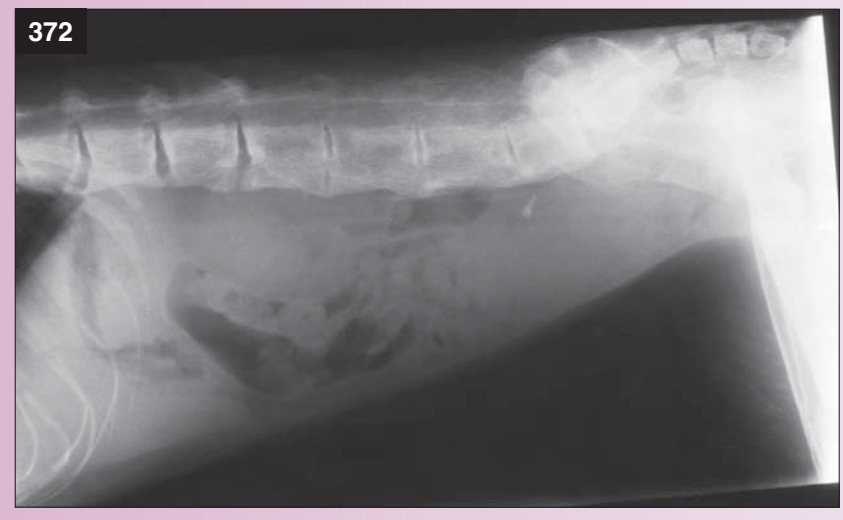
◀ Extensive lateral torso burns in a dog.

13

Miscellaneous disorders

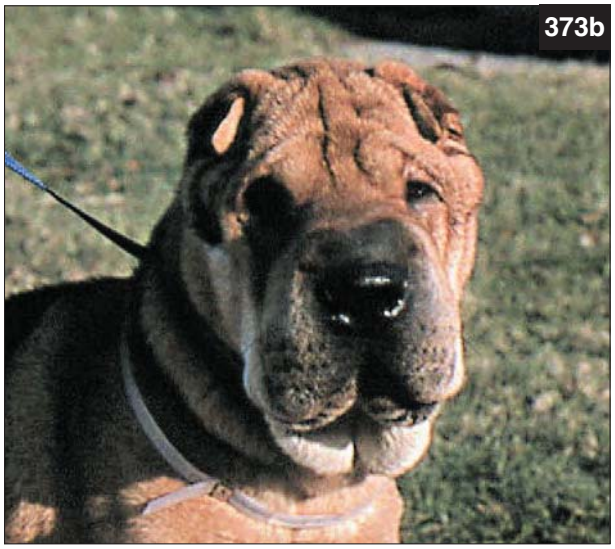
- If you don't think it, you won't find it.
- Don't forget to include nutrition, geographic location, and present medications (including 'over-the-counter') in the history.
- Care for each and every patient as if it were your own pet.
- Don't drug your patients to the point of being unable to evaluate them.

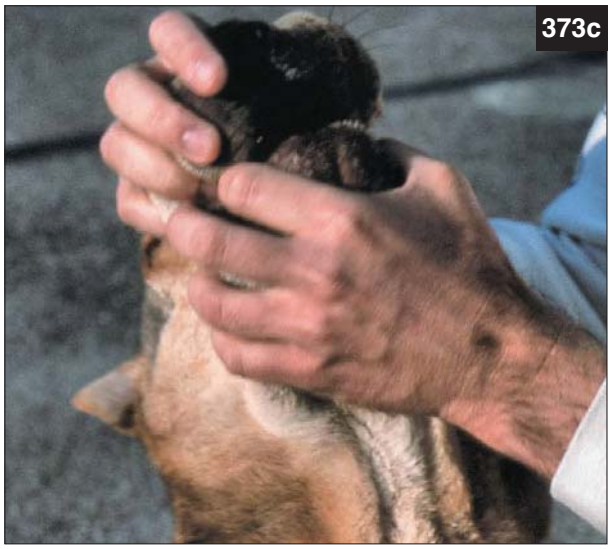
371 Septic shock.
The marked hypoperfused mucous membranes of this dog are typical of the hypotensive (hypodynamic) phase of septic shock. These patients require intensive medical care, intravenous fluids, and vasopressor agents if they are refractory to the fluid therapy.



372 Hypervitaminosis A.
This lateral abdominal radiograph of an older cat shows confluent and exuberant exostoses involving the vertebrae and ilium, which is one of the signs of vitamin A excess in this species. The cat's diet consisted mostly of liver, which contains high amounts of vitamin A.

373a–c Atrophic myositis. This Shar Pei has atrophic fibrosing myositis, which is responsible for its inability to open its mouth. Note the temporomasseter muscle atrophy, which has caused the trismus (inability to open mouth).





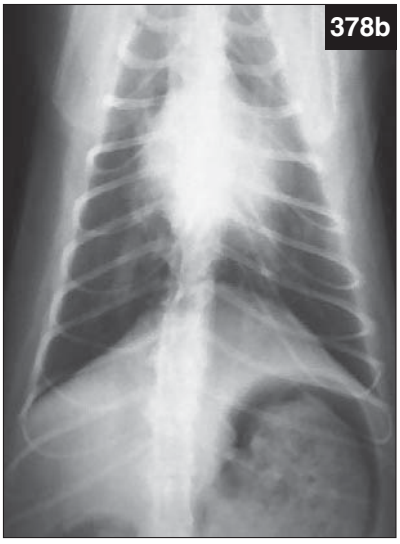
374 Intraosseus fluid treatment. The intraosseus route of parenteral fluid therapy is very effective for delivering fluids to a critically ill patient when a vein cannot be isolated for cannulation. A 20 gauge needle can be used effectively as a bone marrow needle in very small patients, such as this kitten. It is important to make a small skin incision with a scalpel blade before inserting the needle in order to avoid skin plugging the needle opening.

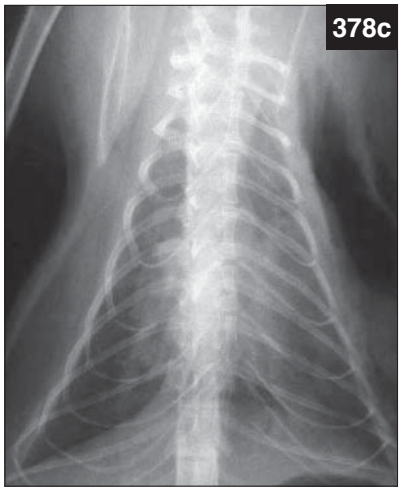
375 Burn injury.
Iatrogenic skin burns are commonly caused by hospital warming devices that are used to maintain normal body temperatures. Lying on these pads for too long a time can cause combined pressure and temperature-related skin tissue injury and eventually major tissue sloughing. The dorsal region of this dog will eventually slough most of the skin and require extensive repair with skin grafting.

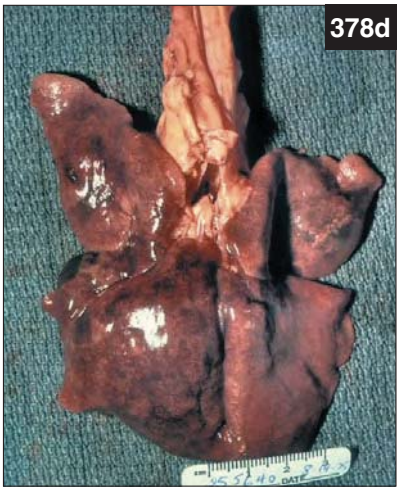
376a–c Burn injury.
This Schnauzer was trapped in a house fire and suffered facial mucosal and extensive burns involving its trunk. At the time of admission the extent of such burns might not be appreciated, but with time the heat injured skin will marginate and slough. In this case, meticulous surgical management allowed for complete healing.

377 Burn injury.
This dog suffered extensive lateral torso burns after being struck by an automobile and being dragged while trapped beneath the muffler. The initial main threats to this dog are fluid balance and protein loss and bacterial infection. The uncapped jugular vein catheter is a medical management mistake, as it serves as a portal for bacterial contamination and possible sepsis. The surgical repair procedures will entail numerous skin grafts, topical pig skin, and, perhaps, correction of any adhesions that might restrict the range of motion of the right forelimb.

378a–d Burn and smoke injury.
The hair of this cat has been singed from having been too close to the flames in a burning apartment (**378a**). Other lesions included burn ulcers involving the paws and exposed mucous membranes and pulmonary smoke inhalation. Close watch must be kept on these patients for secondary complications such as bacterial pneumonia and acute respiratory distress syndrome. Thoracic radiographs are advised initially and 3–5 days later in order to detect severe lung pathology such as a secondary pneumonia. The radiographs shown are from a different cat that experienced a similar insult. On day 1 (**378b**) the lungs had no infiltrate, but on day 5 (**378c**) the infiltrate was diffuse, which led to the cat's demise. At necropsy this second cat had diffuse and severe lung pathology (**278d**).





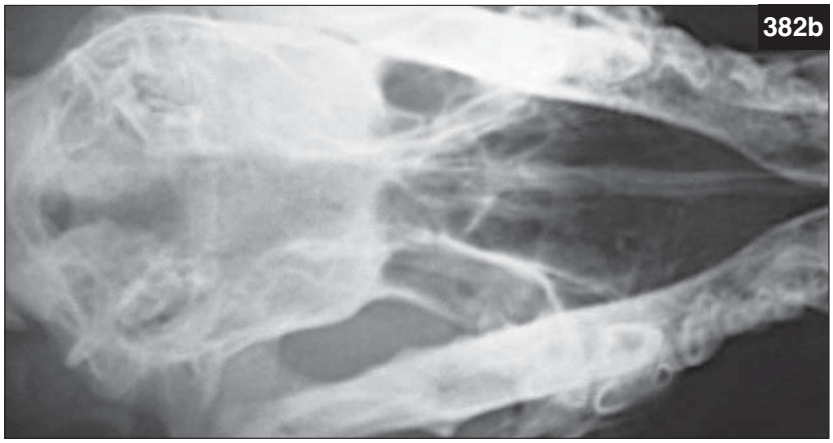


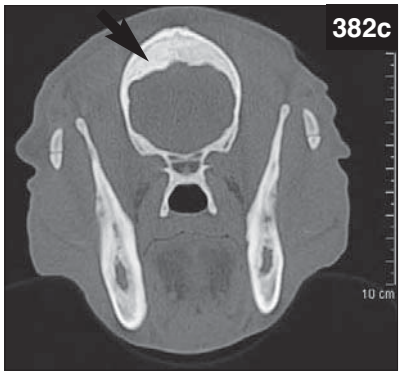
379a–c Congenital lymphedema.
Congenital anomalies of the limb lymphatic vessels can cause lymphedema that characterizes as a cool, pitting edema. This can involve single or multiple limbs. Images **379a** and **379b** are from a German Shepherd Dog puppy. Image **379c** is from a mixed breed puppy and shows its normal and abnormal distal appendages. Certain surgical procedures might benefit some cases.

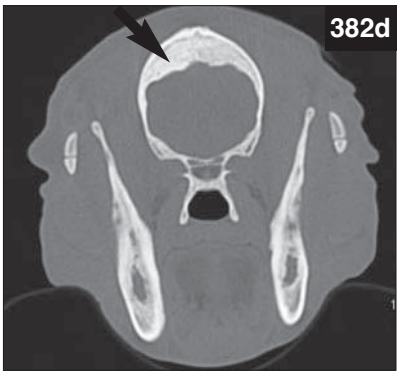
380 Skin laceration from a harness.
This puppy's substantial skin laceration was a result of the owner's neglect by failing to adjust the harness in proportion to the puppy's growth. Superficial wound care and perhaps secondary wound closure often lead to a favorable prognosis.

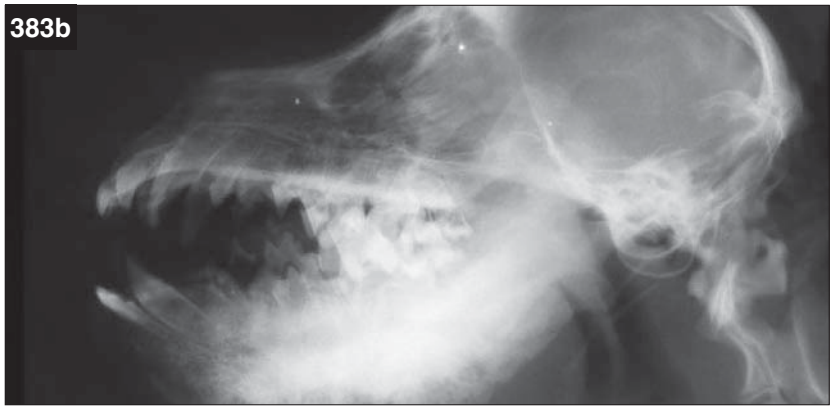
381 Calvarial hyperostosis.
This radiograph from a young Bull Mastiff shows periosteal proliferation of its calvarium. This disorder is particular to this breed and the bone pathology resembles craniomandibular osteopathy of other breeds, with sparing of the mandible.

382a–d Calvarial hyperostosis of the Bull Mastiff.
These two puppies (**382a**) are siblings. The one with the stunted growth is affected with craniomandibular osteopathy. The ventrodoral skull radiograph (**382b**) shows bilateral mandibular thickening, while the CT scans (**382c, d**) show the calvarial thickening (arrows).

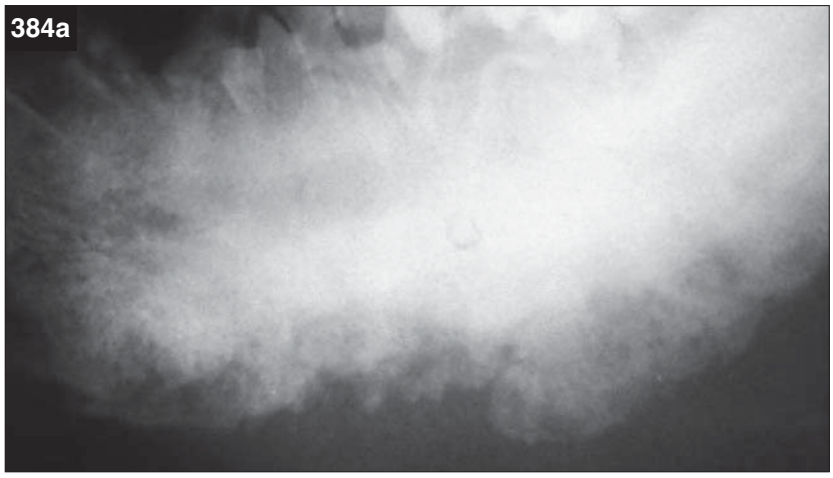








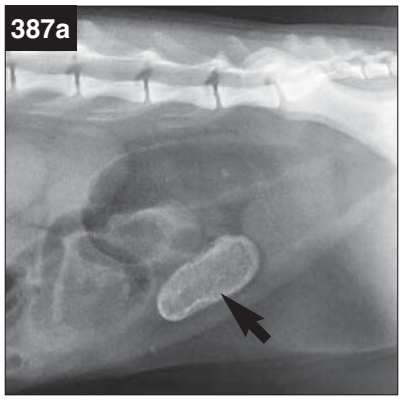
383a, b Craniomandibular osteopathy.
This young Cairn Terrier (**383a**) is severely painful from the early stage of craniomandibular osteopathy. If caught early, this author has stopped its progression using long-term prednisone at a starting dose of 1.0 mg/kg per day and then slowly tapering to where a dose is given on alternate days until approximately one year of age. The radiograph (**383b**) shows another dog with the advanced stage of this disease. This is the stage prednisone treatment will prevent from occuring.



384a, b Craniomandibular osteopathy.
A close-up view of case **382b** shows the marked periosteal proliferation (**384a**). Image **384b** is from a West Highland White Terrier that had ankylosis of the temporomandibular joint, which greatly restricted its mouth movements while it was alive.

385a–d Craniomandibular osteopathy: early.
This 16-week-old Cairn Terrier (**385a, b**) has anterior mandibular thickening that was detectable on physical examination. The radiograph of the mandible (**385c**) shows the periosteal proliferation (arrow). Image **385d** is the puppy reported to be doing well after 3 weeks of prednisone treatment. It was impossible to hold this puppy still for the photographs!

386a, b Chylous peritoneum. These three large bottles of chylous abdominal effusion (**386b)** were drained from the abdomen of a miniature Schnauzer (**386a**). The cause was never determined in this dog, but it can result from blunt abdominal trauma, tearing of the lymphatics, congenital malformations, and various causes of lymphatic obstruction. Periodic repeated drainage procedures on an outpatient basis became necessary for this dog. The owner declined the offer for a surgical exploratory.

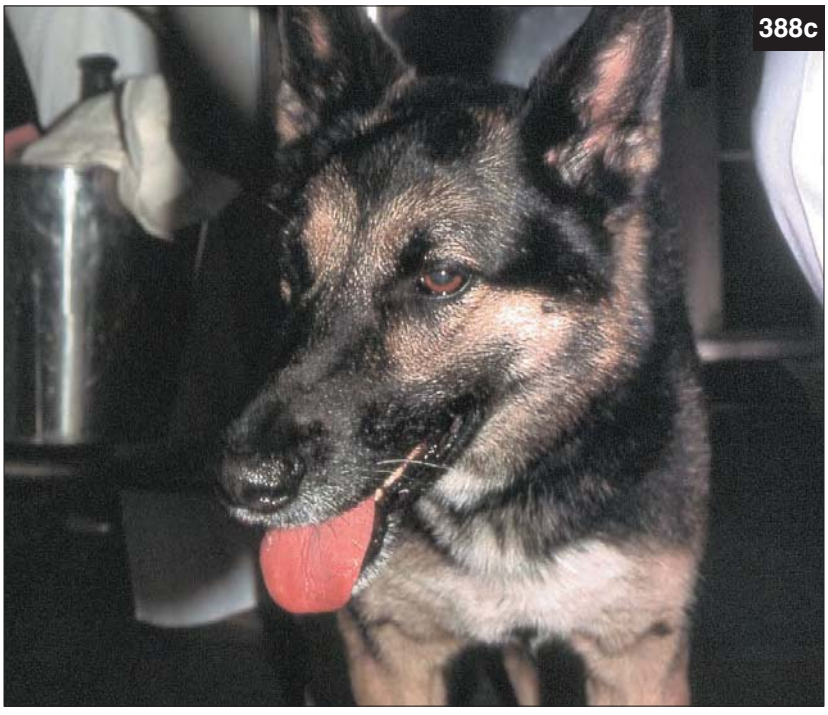


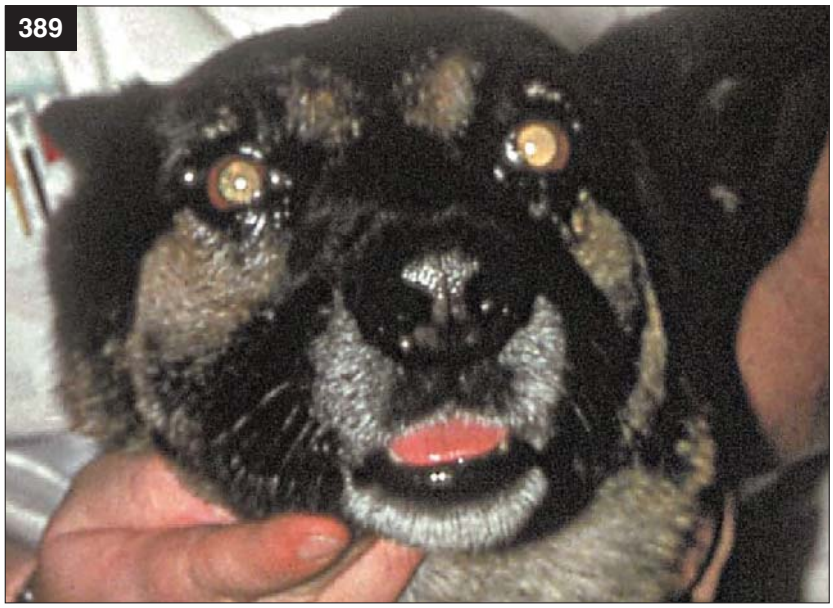
387a, b Intraabdominal foreign body. The radiopaque density in the abdominal cavity of this cat was detected on routine examination for vaccinations. Surgery was performed and the foreign body (arrows) was discovered to be a surgical sponge from its previous ovariohysterectomy, which was done several years before.

388a–c Eosinophilic myositis.
Image **388a** is of the dog in **388** and shows its swollen bulging masseter muscle before prednisone was given parenterally. Image **388b** was taken 24 hours after prednisone administration. Improvement occurred by the second day of hospitalization (**388c**). Diagnostic tests such as muscle biopsy, electromyography, and antimuscle antibody titer were not done in this case.

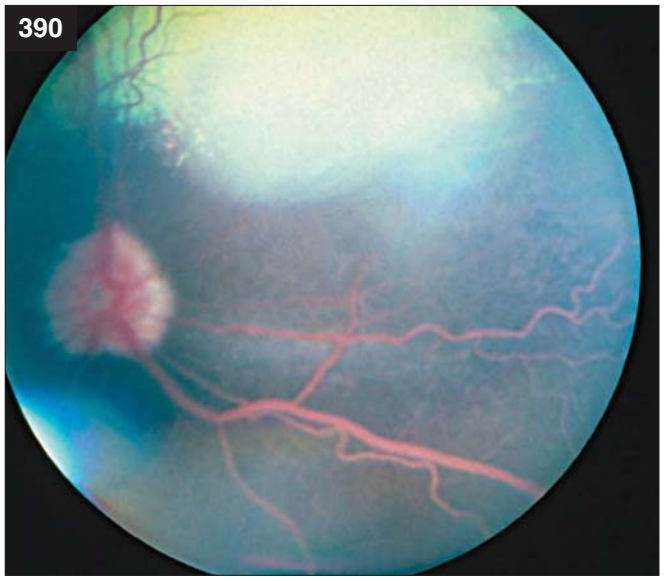

388a


388b

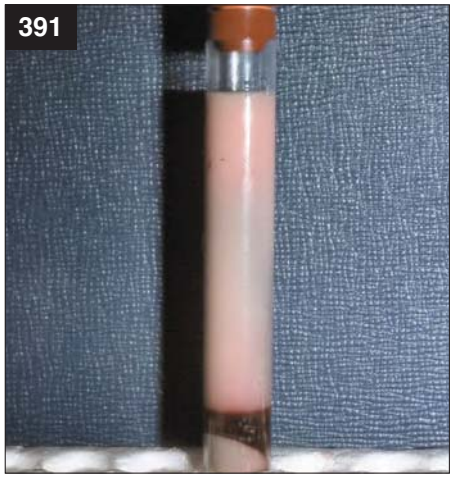

388c



389 Eosinophilic myositis.
This German Shepherd Dog had difficulty opening its mouth and exposure conjunctivitis due to the exophthalmos caused by the temporomasseter and extraocular muscle inflammation.

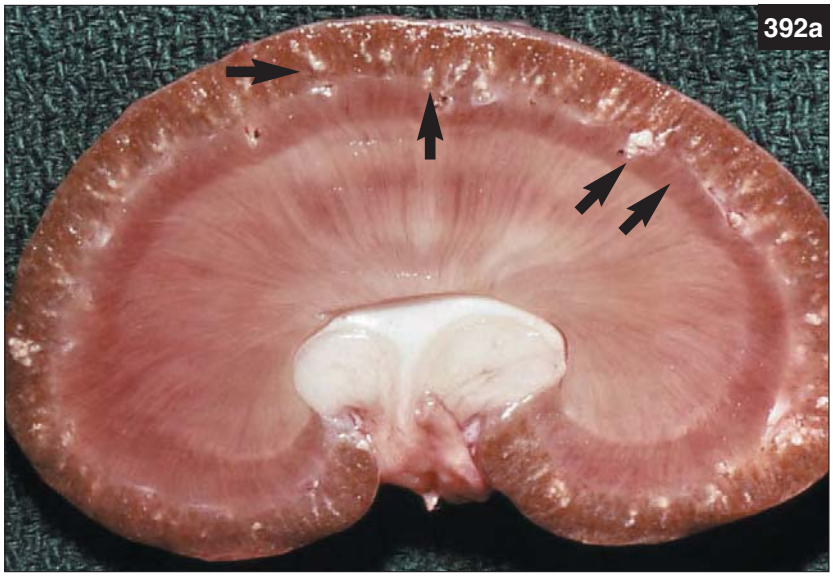


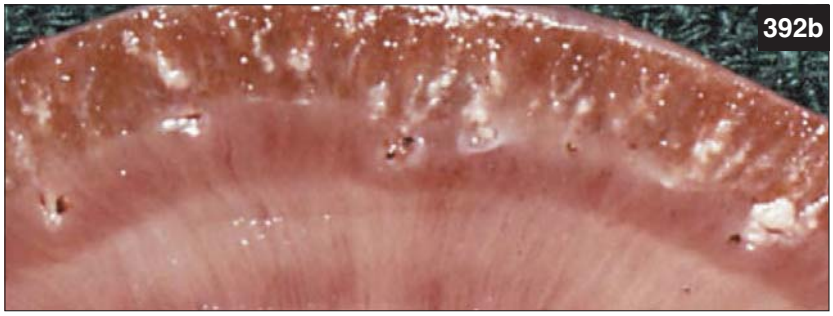
390 Hyperlipidemia: lipemia retinalis.
This fundoscopic view from a hyperlipidemic dog shows opalescent lipid in the aqueous humor and retinal blood vessels. (Image also shown in case **38**, p. 36.) This condition can occur in any patient that has pathologic hyperlipidemia from hypothyroidism, primary hyperlipidemic disorders, and others.

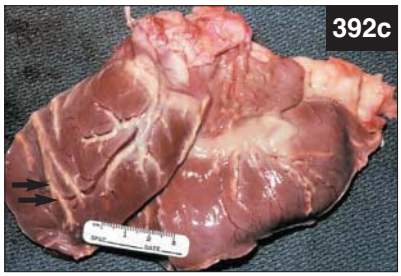


391 Hyperlipidemia.
This lipid-dense serum sample was from a severely hypothyroid dog. Further diagnostic tests such as cholesterol measurement and lipoprotein electrophoresis will further define the nature of the problem. This same phenomena can occur in any normal dog if serum is taken soon after the ingestion of a fatty meal.

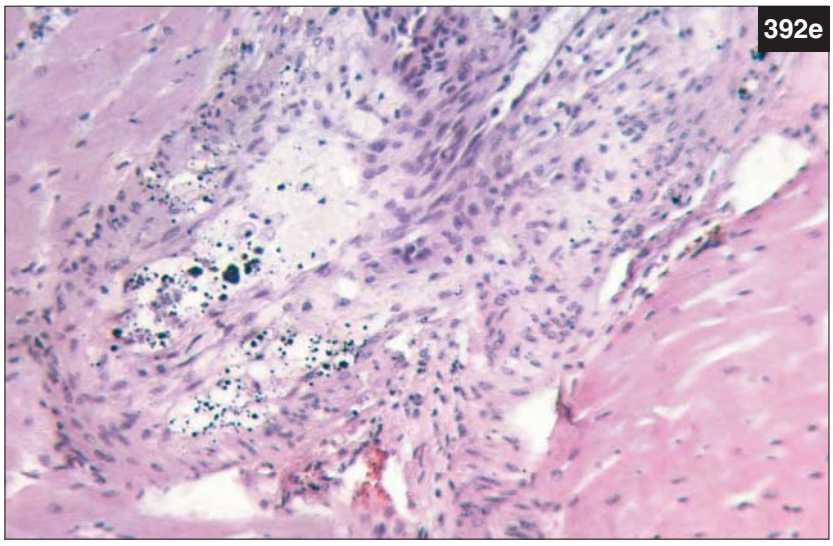
392a–e Hyperlipidemia. These postmortem views show white cholesterol emboli (**392a, b** – arrows) involving a dog's kidney and lipid laden coronary and prostatic arteries (**392c, d** – arrows). This dog also had severe atherosclerosis, as shown in the photomicrograph (**392e**). The cause was severe hypercholesterolemia and hypertriglyceridemia due to advanced hypothyroidism.

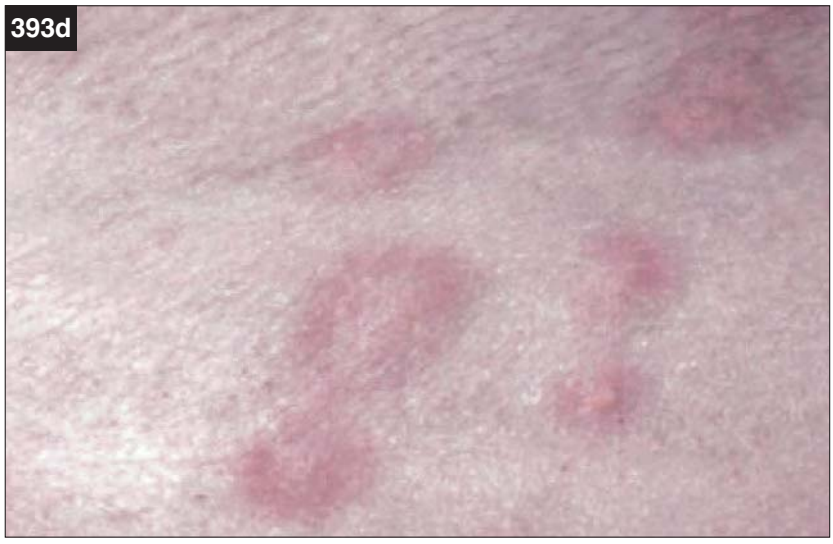

392a


392b


392c

392d


392e



393a–d Fire ant bites. In the southern part of the United States, puppies and kittens can become victims to fire ant (***Solenopsis invicta***) envenomation. A massive swarm can even kill the victim. If it survives, the typical skin lesion is initially papular (**393a**) and it then converts to a pustule as shown in images **393b–d**. (See also case **9**, p. 19.) Treatment is supportive, consisting of intravenous crystalloid, glucocorticoid, and antihistamine drugs. Also seen in case **9**.

394a–d Hypertrophic osteodystrophy.
This syndrome affects young dogs and can cause severe debilitation because of accompanying fever, pain, and inability to use the affected limb(s) (**394a, b**). Metaphyseal osteolysis is a typical radiographic feature of this disease (**394c, d**). Dietary oversupplementation is thought to contribute to its occurrence. There are reports describing bacteria playing a role in this syndrome, similar to osteomyelitis, with some cases being responsive to antibiotic treatment.


394a


394b


394c


394d

395 Skin slough.
Subcutaneous isotonic fluid administration over the scapula predisposed this Doberman Pinscher puppy to substantial tissue loss. A large deposited volume can compromise the blood supply in the hypodermis, leading to skin necrosis and slough.

396 Hypocalcemia.
The general seizure in this cat was caused by acute hypocalcemia that occurred after it received a hypertonic enema solution containing sodium and phosphorus for its obstipation condition. These hypertonic enema preparations are contraindicated in small animals, and in particular in those with chronic renal insufficiency, because of the hypocalcemia and hyperphosphatemia that can occur if the solution is allowed to be absorbed through the colonic mucosa, which will certainly occur with obstipation.

397 Hypocalcemia: eclampsia.
Paraparturient hypocalcemia usually occurs postpartum and is common is small breed dogs. This Poodle is showing signs of tetany. It was reversed with a slow intravenous infusion of 10% calcium gluconate solution (1–1.5 ml/kg) over a 30 minute time period.

398a, b Hypokalemic myopathy.
Both cats and dogs can have severe muscle weakness with hypokalemia. The weak neck muscles are typical and result from the hyperpolarized muscle cell membranes caused by the hypokalemia. This cat had hypokalemia with diabetic ketoacidosis (**398a**). Treatment initially was with intravenous fluids with added potassium chloride before beginning insulin treatment. This would prevent further lowering of the serum potassium level by insulin by moving it into the intracellular space. This condition will respond to potassium replacement treatment, in addition to treatment for the primary underlying disease (**398b**).


398a

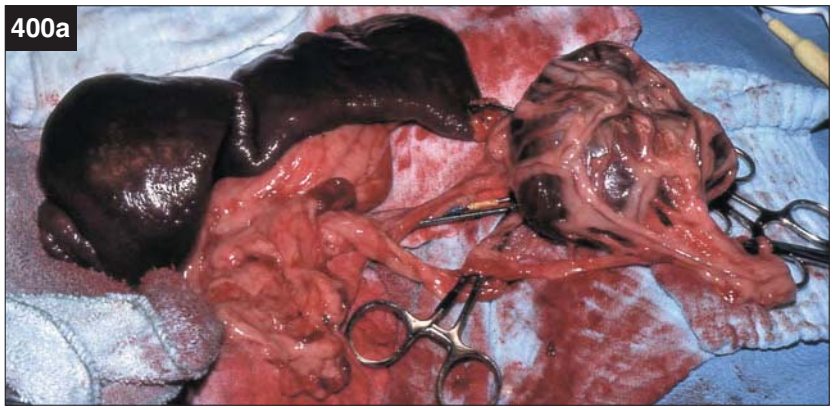

398b

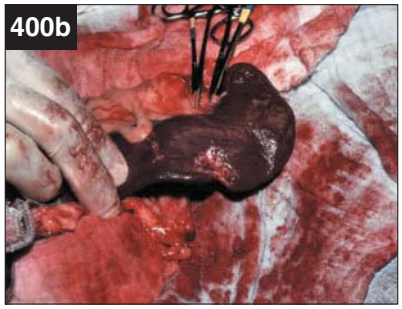
399a–c Hypokalemic myopathy.
The marked cervical muscle weakness in this Poodle was caused by hypokalemia that occurred from excessive doses of desoxycorticosterone pivilate. The dog had Addison's disease, but was only glucocorticoid deficient. Shown are images of the dog while it was hypokalemic (**399a, b**) and after the serum potassium level had returned to normal (**399c**).


399a

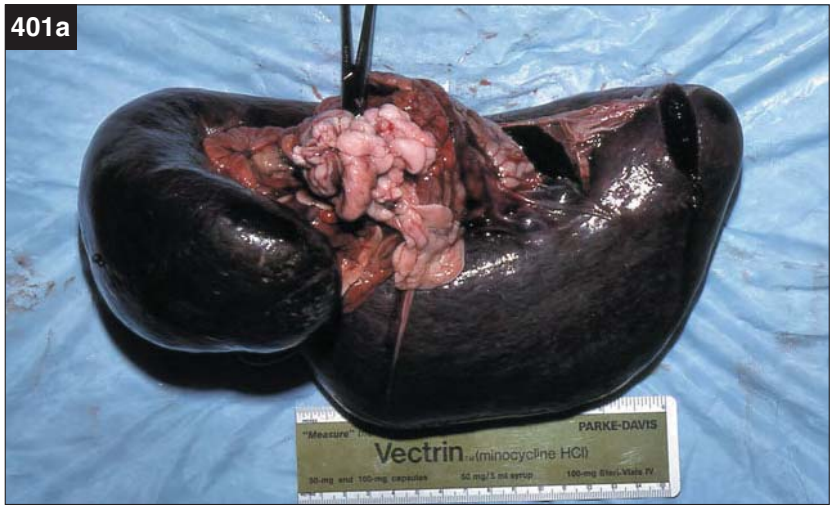

399b


399c





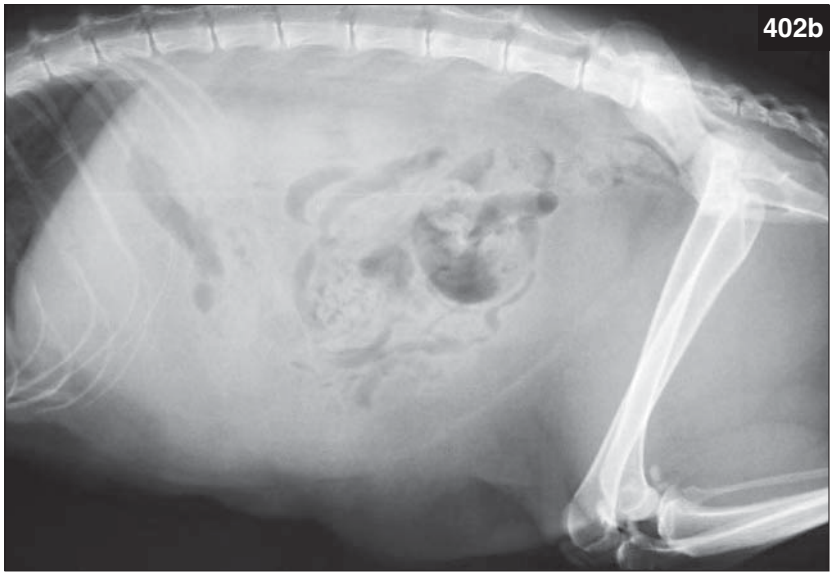
400a–c Splenosis. Sometimes, ectopic splenic tissue is discovered during a laparotomy. It is usually due to fragments of spleen that are broken off the organ because of a previous trauma. Shown is the spleen (**400a**), the splenic fragment (**400b**), and the site where the fragmentation occurred (**400c**).

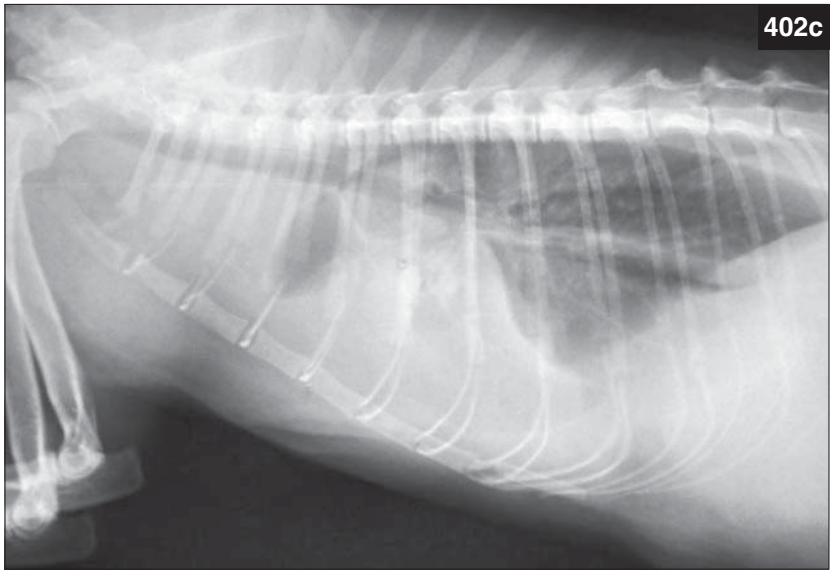


401a, b Splenic torsion. The spleen in this image (**401a**) is torsed several times around its pedicle. This dog, surprisingly, was not in shock. The spleen spanned the length of the abdomen and then doubled back on itself (**401b**). The dog did well after splenectomy.

402a–c Pansteatitis. Feline pansteatitis (also known as yellow fat disease) is a painful inflammatory syndrome involving body fat deposits caused by the ingestion of rancid fats found in poor quality tuna. This cat is painful and anxious and resisted being handled (**402a**). The radiographs (**402b, c**) show diminished fat radiographic density and loss of abdominal contrast as a result of the inflamed abdominal fat. There is also a pleural effusion caused by the steatitis, which worsens the prognosis. The effusion characterizes as a sterile exudate with a neutrophilic predominance.


402a


402b


402c

403a, b Pansteatitis. A surgical abdominal exploratory showing the typical 'yellow fat' disease and some mesenteric lymph node enlargement (**403a**). Image **403b** is from a different cat but showing the same disorder. Vitamin E and prednisone were used to treat these cats, along with diet change. The diagnosis can be more easily reached by simply taking a biopsy of the subcutaneous fat, thus sparing these patients any added insult.

404a–c Polyarthritis. Inflammatory polyarthritis in the dog is probably due to an immune-mediated process. It can have both erosive and nonerosive types. The radiographs of the tarsus (**404a, b**) show soft tissue swelling and severe joint destruction causing bone subluxation and a loss of the interarticular spaces. The radiograph of the carpus (**404c)** shows osteophyte formation and some collapse of the intercarpal spaces.

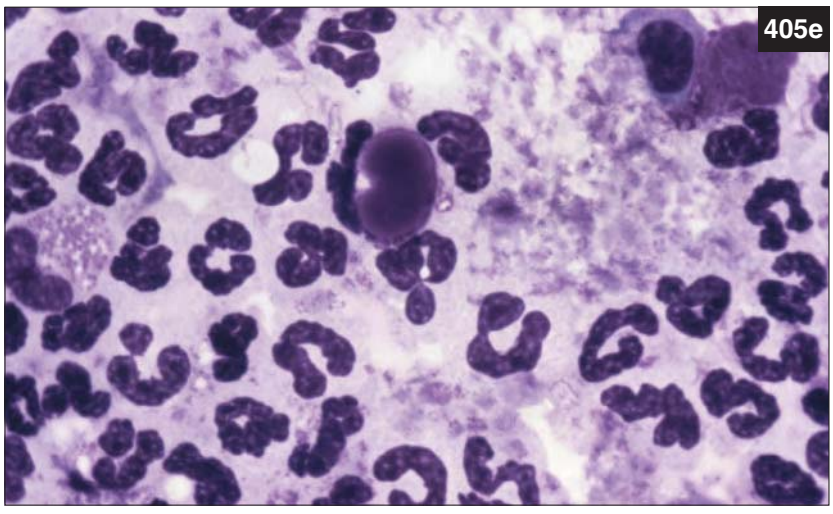
405a–e Polyarthritis.
Immune polyarthropathy in this Irish Setter was accompanied by a diffuse painful joint swelling (**405a, b**) and fever as high as 40.5°C (105°F).
The radiograph of the carpus (**405c**) shows periarticular soft tissue swelling with preservation of the carpal interspaces. The arthrocentesis sample was watery and serosanguineous (**405d**); the joint fluid cytology was predominantly neutrophilic (**405e**). Diagnostic tests should first eliminate a possible infectious origin before treating with any type of immunosuppressive drugs.


405a


405b


405c

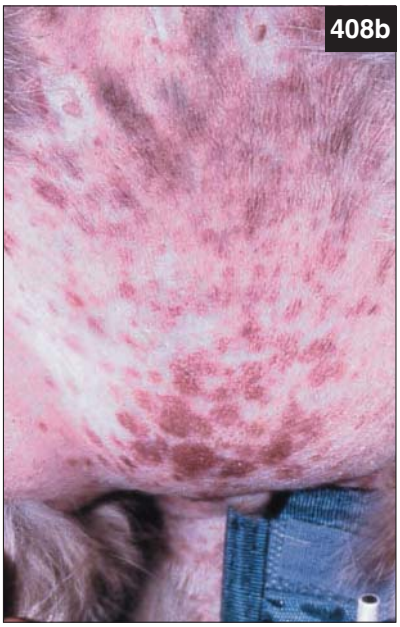

405d


405e

406a, b Thiamine deficiency. The blank gaze (**406b**) and cervical flexion seizures (**406a**) are characteristic of brain dysfunction from thiamine deficiency in the cat. Other signs include ataxia and dementia. Certain thiaminase-containing fish diets can cause this condition, but prolonged thiamine deprivation can also cause this deficiency state and syndrome. Early treatment can be curative, while delayed or no treatment can have severe consequences. Thiamine hydrochloride injection should only be given IM or SC, because it is anaphylactogenic when administered by IV push.

407 Thiamine deficiency. Cats are very susceptible to thiamine deficiency because they have high dietary requirements and there are no body stores for this vitamin. This cat (**407**) shows the characteristic demented stare with mid-dilated pupils before treatment. Clinical signs and an index of suspicion form the most practical basis for making this clinical diagnosis.

408a, b Vasculitis.
The petechiations in this cat were caused by vasculitis that occurred as an adverse drug reaction to vincristine. The cat's platelet count was normal. Fever was also present. Skin biopsies were taken in order to confirm the diagnosis. The cat responded to glucocorticoid treatment and discontinuation of the vincristine treatment.



409a, b Hypoglycemia.
Anorectic pediatric patients are particularly prone to hypoglycemia and associated weakness and mental depression, as shown in this Maltese puppy (**409a**). Its response to an intravenous bolus of dextrose solution (0.25–0.5 g/kg) was immediate (**409b**). Care must be taken to avoid overdosing the dextrose solution because excess amounts can cause life-threatening hyperosmolality, with accompanying adverse effects on the brain.

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